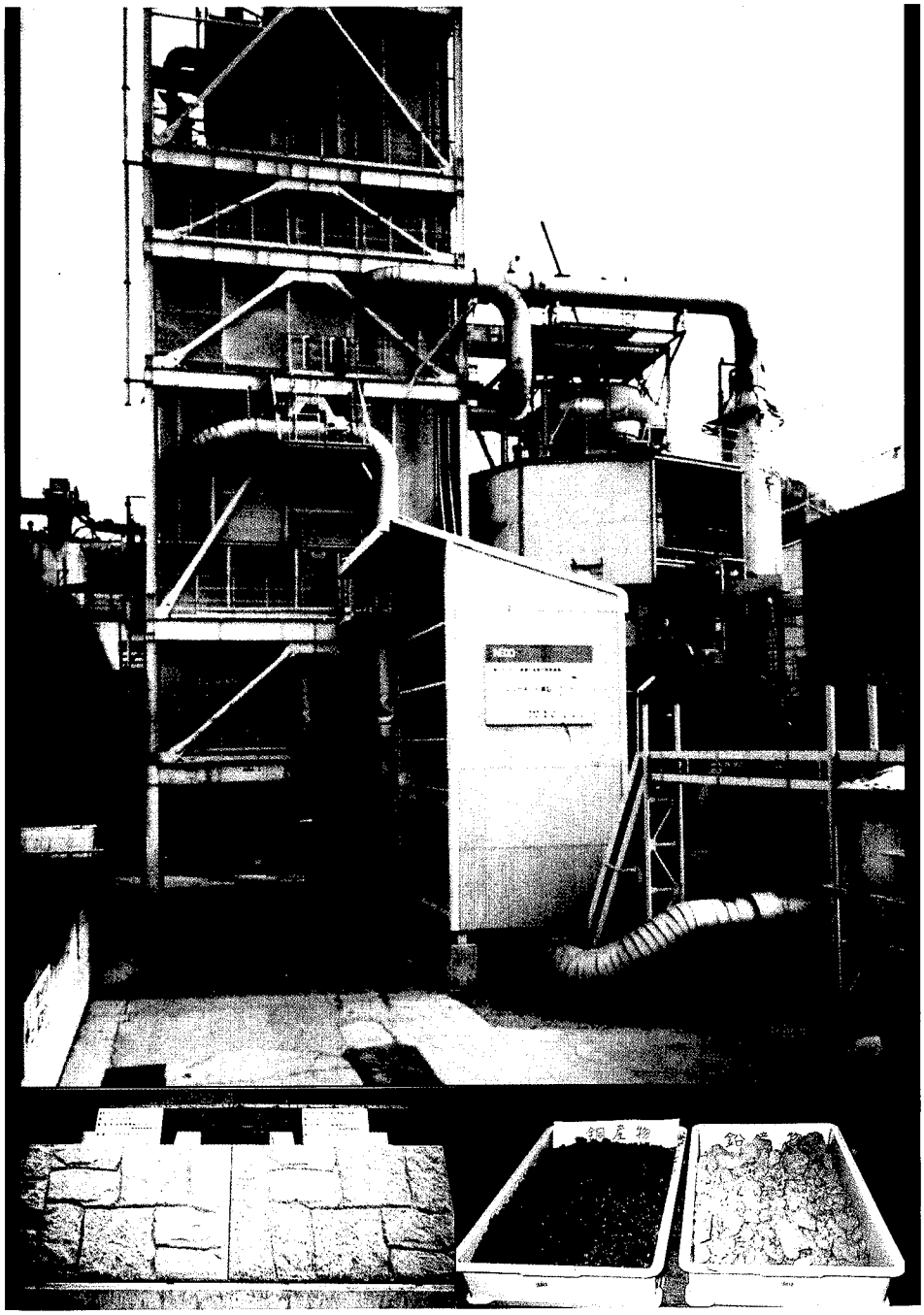
ISSN 0916-7978

PB99-177701

Vol. 25 No.8 November, 1997

NEW TECHNOLOGY JAPAN



JETRO

NEW TECHNOLOGY JAPAN VOL.25 NO. 8

The aim of our magazine is to promote the international exchange of technology through the introduction of Japanese New Technology.

Publisher:
Japan External Trade Organization, Machinery and Technology Dept.
2-2-5, Toranomon, Minato-ku, Tokyo 105, Japan
Tel: +81-3-3582-4631 Cables: JAPANETRO TOKYO Telex: J24378 Fax: +81-3-3582-7508

Editor:
Three "I" Publications, Ltd.
2-2-5, Uchikanda, Chiyoda-ku, Tokyo 101, Japan
Tel: +81-3-3256-3100 Fax: +81-3-3256-3170

Inquiries Concerning Published Articles

Please place inquiries on published articles directly with the firm concerned. If you require further technological information, please write to the firm concerned or editor.

Comments on the Magazine

Please send your comments concerning editorial matters of the magazine to the publisher or editor.

Cover Photo: Eco-Cement Plant -Municipal Solid Waste Incineration Ash Converted to Cement-[Chichibu Onoda Cement Corporation]-(Story on Pages2-4)

CONTENTS

KEIRIN 本印刷物は，日本自転車振興会から，競輪収益の一部である機械工業振興資金の援助を受けて作成したものである。

NEW TECHNOLOGY & PRODUCTS 16

Advanced Materials

Electronics & Optics

Machinery & Mechatronics

Information & Communications

Process & Production Engineering

Construction & Transportation

Energy & Resources

Environment

Biotechnology & Medical Science

FLASH 41

INNOVATIVE PRODUCTION NOW

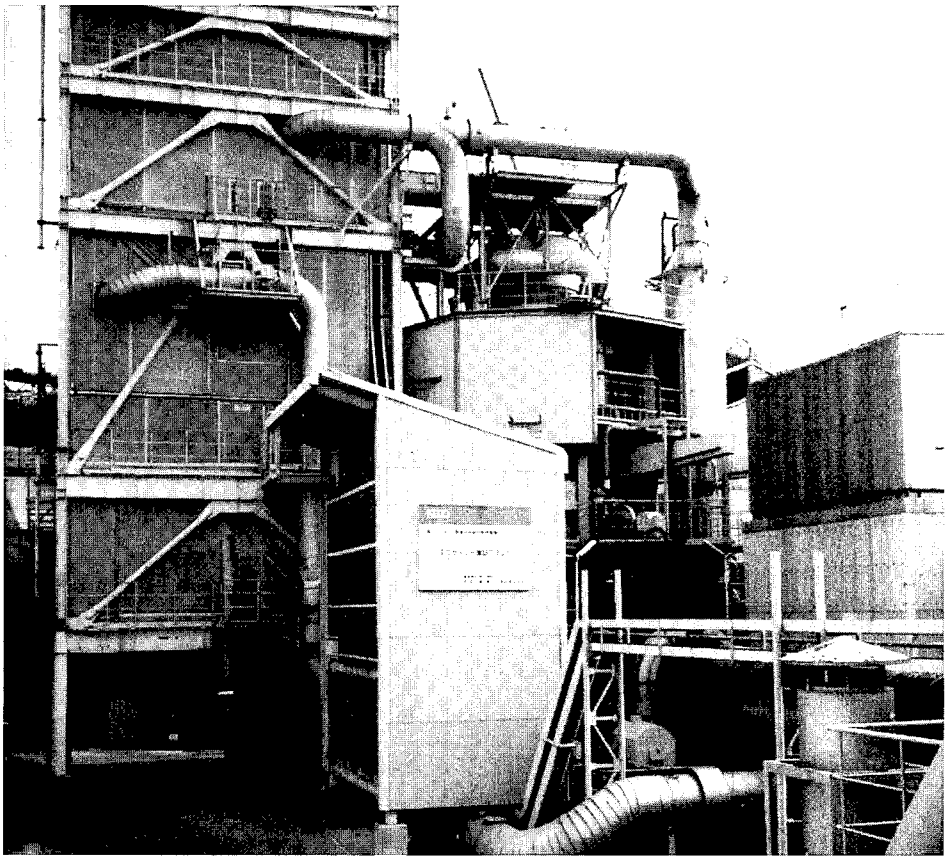
This section describes a specialized section or whole process of a representative factory which excels in specific aspects of production.

Eco-Cement Pilot Plant - Municipal Solid Waste Incineration Ash Converted to Cement -

1. Introduction

The Tahara Plant of Mikawa Onoda Corporation, a subsidiary of Chichibu-Onoda Cement Corporation, is located at Tahara-cho, Atsumi-gun, Aichi Pref. and takes about 3 hours 30 minutes from Tokyo via local stop Shinkansen and local railway. Formerly, this plant produced portland cement, but at present the plant only produces other products, and is mostly used for research and development proving facilities. The total land area is 57,000 m^2 and managed by 27 researchers and technicians. In this site, two major operational development and proving projects are underway: the Eco-Cement Project and the Chlorine Contained Duct Recycling Demonstration Project.

This issue introduces the outline of the projects and pilot or demonstration plants.

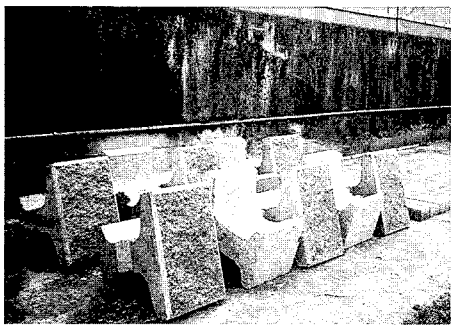


Eco-Cement manufacturing kiln former used for Onoda RSP process development

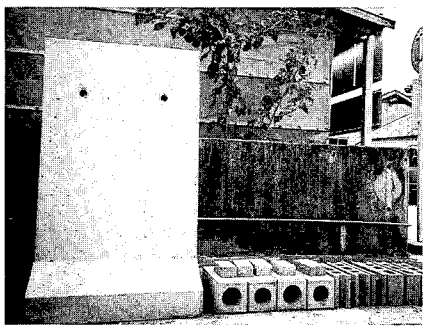
2. Development of Eco-Cement

(1) What is Eco-Cement?

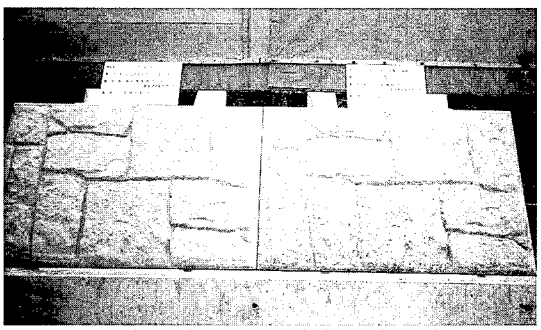
Eco-Cement is a cement that is produced from the composition of raw materials resulting from the addition of limestone to ash generated by the incineration of municipal solid waste and sewage



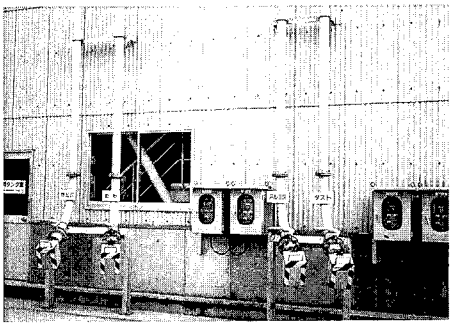
Eco-Cement based concrete blocks



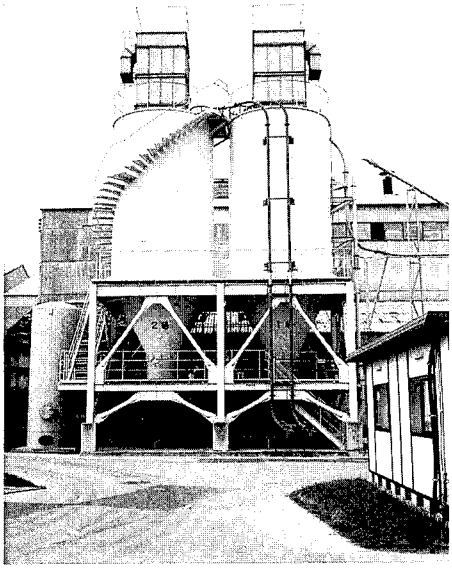
Eco-Cement based concrete products



Eco-Cement based concrete (left) and portland cement based concrete (right) products

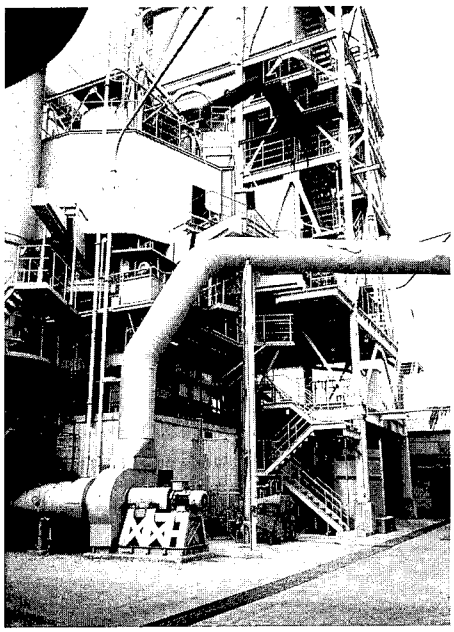


Incinerated ash and other materials receiving facilities (Pneumatic system)



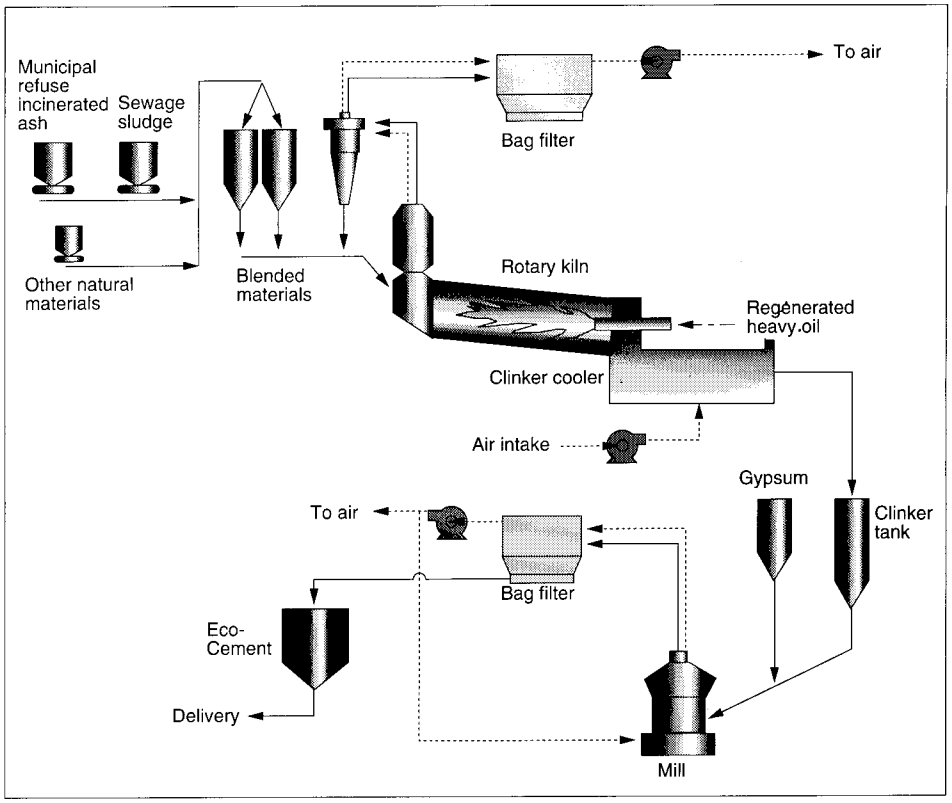
Raw material blending silo

sludge that has been treated and dried. One of the features of Eco-Cement is that its hardening time is shorter than that of ordinary cement. Since chlorine is one of the components in Eco-Cement, it is expected to be used in fields such as nonferro-concrete products, etc.



Raw material dryer

Fig. 1 Eco-Cement Manufacturing Process

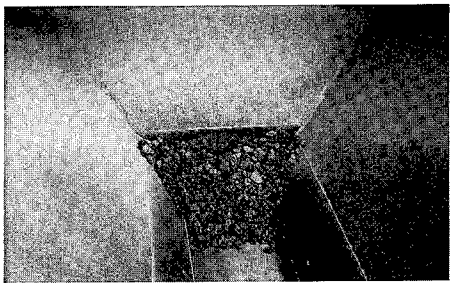


Reducing fuel costs has also become an important issue, since the production of cement requires the consumption of large amount of energy. The utilization of industrial waste as a fuel is among the technologies that have been developed for the purpose of achieving such reductions. The development of Eco-Cement adds to this economic objective by combining it with the disposal of incineration ash from municipal solid waste in a way that contributes to the benefit of society.

(2) Background of the Project Planning

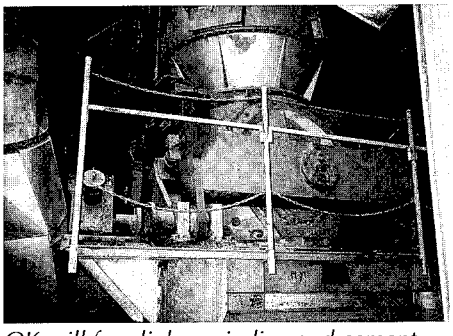
In the world's first development of its kind, Eco-Cement which is a construction material for civil engineering applications that has been produced from incineration ash from municipal solid waste, treated sewage sludge, plastic waste, etc., has been placed into practical use.

The disposal of the growing amount of incineration ash from burned refuse has become an increasingly serious problem in Japan in recent years. Changes in the surrounding environment and other factors have made it difficult to secure final disposal sites. In addition, legislative amendments have now made it impossible to

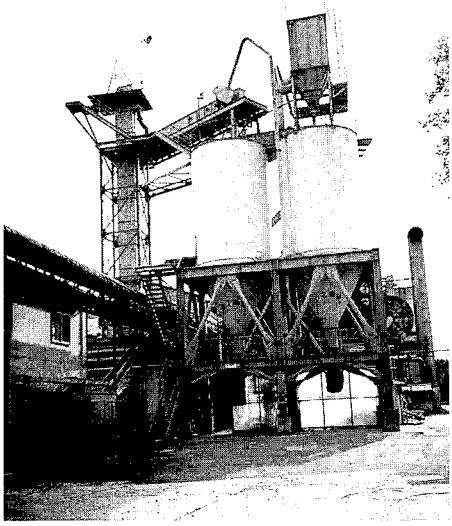


Clinker chute for grinding

Clinker sampling



OK mill for clinker grinding and cement production



Clinker silo

bury fly ash that has been collected in dust collectors until it has been treated to detoxify it.

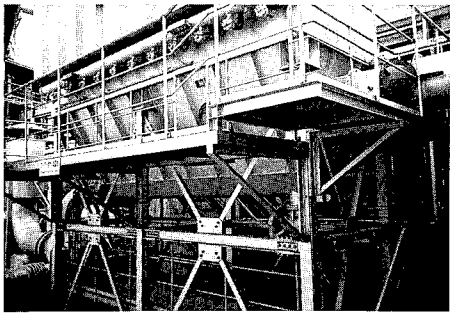
Under these circumstances, a means of treating fly ash, other than by burying it in landfill was urgently required, and a plan for an Eco-Cement experimental plant emerged from the concept of recycling refuse into a useful resource.

(3) Experimental Plant

Planning for the Eco-Cement experimental plant started at the beginning of fiscal 1993. Chichibu Onoda Cement Corporation served as the developer that initiated research themes relating to Eco-Cement and Mikawa Onoda Cement Corporation, affiliate of Chichibu-Onoda, constructed the experimental plant with a production capacity of 50 tonnes/day at its site in Aichi Prefecture. Verification tests were carried out with the target of having Eco-Cement in practical use within a five-year period ending with the close of fiscal 1997, but the period extended to FY1998.

Research was performed on (1) establishing technologies for producing cement on a long-term basis, (2) obtaining an understanding of the composition, compression strength and other physical properties of the cement produced and then improving these characteristics, and (3) developing methods to treat waste gases and other measures to protect the environment.

The raw materials required to produce 1.0 ton of Eco-Cement are approximately 500 kg of incineration ash (generated from 5.5 tons of municipal solid waste), 300kg of treated sewage sludge , and 300 kg of filler materials. Clinker is produced when these raw materials are subjected to crushing and firing processes; Eco-Cement is produced when gypsum is added to the clinker.



Bag filter

(4) Trouble-free Processing of Chlorine-based Plastic Waste

The greater problem in the verification experiments was the presence of chlorine in the incineration ash from municipal solid waste, since it was anticipated that the use of chlorine as a raw material in cement would pose difficulties with regard to the strength of the cement. It was also thought that the chlorine would cause rust in ferrous metals used to reinforce structures built with such concrete and that shutdowns would be caused in the machinery used in the cement production process, since the raw material would clog the equipment during the high temperature firing stage.

For these very reasons, the presence of chlorine is one of the most severe problems that is also faced in the recycling of industrial waste. Pretreatment is necessary at present to remove the chlorine from materials that contain it before the materials can be processed in many other types of recycling systems.

In the Eco-Cement experimental plant, however, all of these problems have now been fundamentally solved by using a system that has been created to accept all of the incineration ash from municipal solid waste as it is without the need for complicated pretreatment operations. It can be said that this represents a system which can accept and is resistant to materials containing chlorine, and that Eco-Cement is thus a development that will bring good news to the entire plastics recycling industry in the future.

(5) Use of Chlorine with Extracted Heavy Metal

Small amounts of heavy metals are also contained in the incineration ash from municipal solid waste and it is necessary to remove these components during the production process for cement. Here, it is necessary to add chlorine to the heavy metals when removal of them is required, and plastic waste that contains it can thus serve as a secondary source of this element.

While most types of plastic waste can be recycled and used as fuel in cement plants, it can be said that the positive utilization as a supplementary source of chlorine is a unique feature of the Eco-Cement production process.

(6) Construction of an Eco-Cement Production Plant

According to a newspaper report on July 8, the 31 cities, towns and villages in Tokyo's Tama district will jointly undertake the construction of an Eco-Cement production plant. This plant will use the 130,000 tons of incineration ash generated annually in this area as raw material.

The plant will cost about ¥20 billion and is expected to begin operation in 2001. Production technology has already been confirmed as effective as a project of the New Energy and Industrial Technology Development Organization (NEDO) participated in by the Chichibu Onoda Cement Corporation and other companies.

(7) Local Governments Show Great Interest

The success of the Eco-Cement experiment plant has attracted intense interest from local governments throughout the country since all of them are concerned about the problem of handling increasing amounts of incineration ash. Approximately 75% of the municipal solid waste in Japan is presently treated by incineration, but governmental studies are now under way at both the national and local levels on the construction of Eco-Cement plants to serve as a new auxiliary measure to dispose of waste. It is anticipated that the building of such plants will begin in the near future, starting with facilities in the large metropolitan areas.

Since Eco-Cement contains chlorine, it is thought that its immediate applications will be in nonferro-concrete products, soil stabilizers, etc. Since the present annual demand for nonferrous concrete is of the order of 6,300,000 metric tons, it is clear that the amount of incineration ash generated from municipal solid waste is more than adequate for the size of the market. In addition, it is possible to use large amounts of Eco-Cement in tetrapods, artificial reefs that serve as gathering places for fish, and in other concrete products for marine applications.

Manufactured products will be sold by the cement companies operating the plant.

3. Chlorine-Containing Dust Removal and Recycling Demonstration Plant

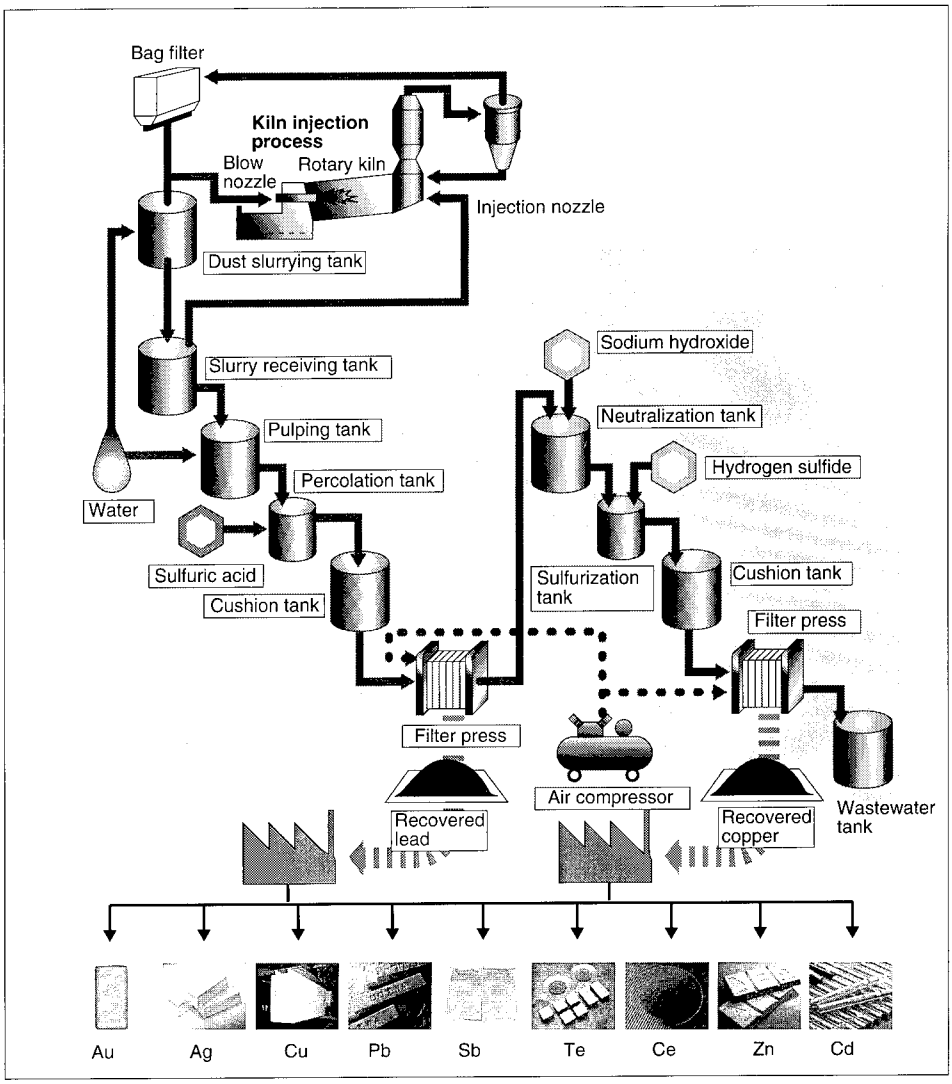
The demonstration plant with a capacity of 200 kg/h (15 kg/batch) was constructed by the Japan Clean Center, and at present the plant is operated for testing by Chichibu-Onoda Cement Corp.

At the cement or municipal refuse incineration plants, chlorinated materials (large chlorinated material-containing dust) are generated by reaction of chlorine and heavy metals in firing, reacting or melting of raw materials or refuse at temperature of over 600°C.

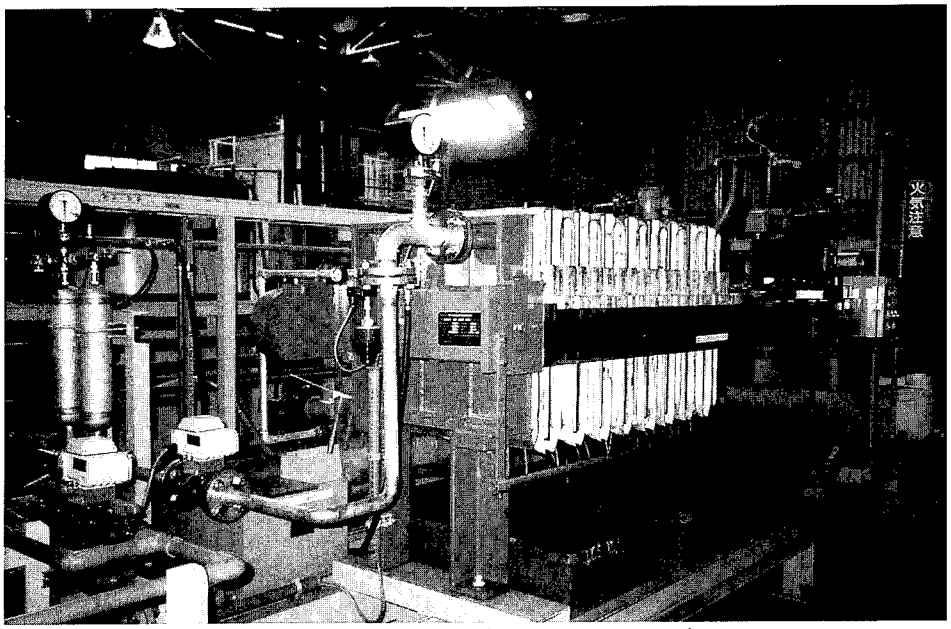
At present, these chlorinated materials-containing dust after cement solidification are special management waste and are disposed of finally in land or a small quantity is returned to the process.

The new process can remove metal compounds from chlorine-containing dust, and extracted the lead and copper as useful resources. Accordingly, this new process is to be installed in the cement plant or municipal refuse incineration plant, and the heavy load on the final disposal site, which is a serious problem in Japan at present, is drastically reduced.

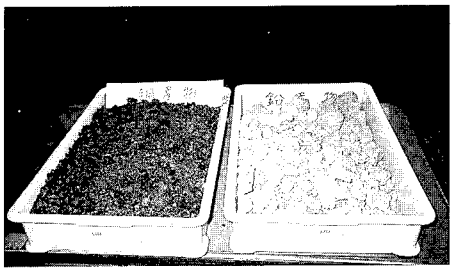
Fig. 2 Chlorine-Containing Dust Removal and Recycling Process



Chlorine-containing dust pretreatment process



Water treatment and filter press in the lead and copper recovery plant



Recovered copper (left) and lead (right)

Chichibu Onoda Cement Corporation
Mr. Hiroshi Obana
Deputy General Manager, Ecocement Program
2-14-1, Nishi-Shinbashi, Minato-ku, Tokyo 105
Tel. 81-3-5512-5195
Fax. 81-3-5512-5248

Mikawa Onoda Corporation
Tahara Plant
2, Abarazaki, Tahara-cho, Atsumigun, Aichi Pref. 441

TOPICS

This section describes selected developments of special importance or interest due to the achievement of a breakthrough or innovation in technology.

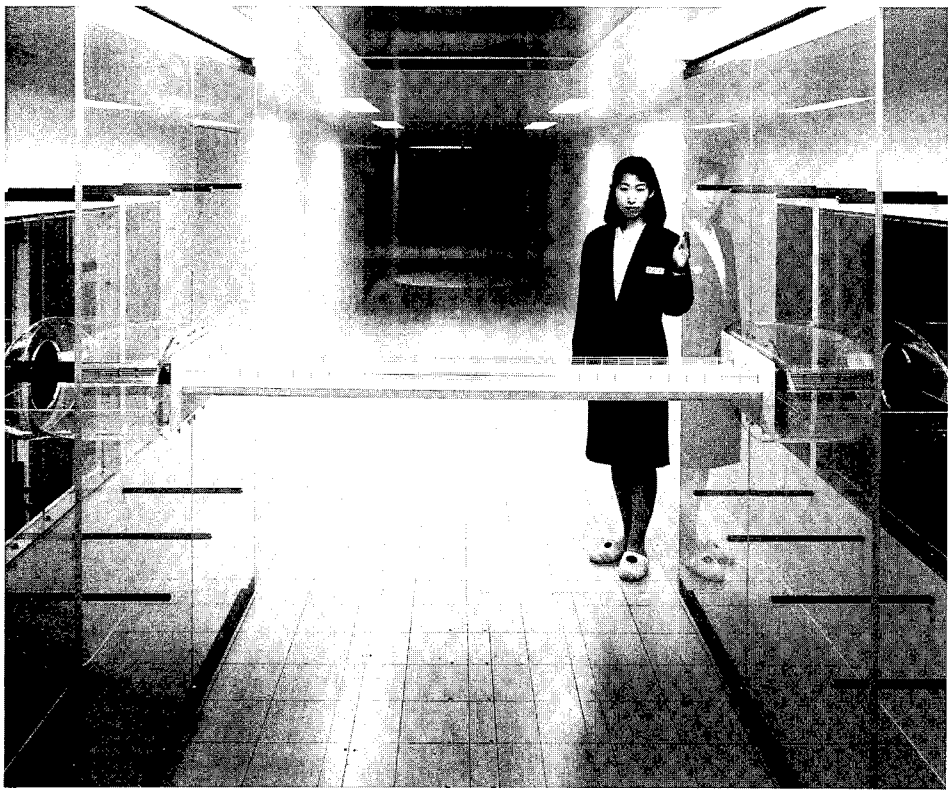
Wind Tunnel for Long Span Bridges

-Clarification of Vibration Generation Mechanism-

KAJIMA Corp. has developed wind tunnel facilities for testing long span bridge models with a maximum length of 200-300 m at its Technical Laboratories in Chofu City, Tokyo. The wind tunnel has various types of testing facilities including a bridge section model test facility by which the models are suspended with springs to measure how the bridge deck is oscillated by winds. These facilities are used to establish vibration suppression techniques primarily for prestressed concrete (PC) cable-stayed bridges. The future plan is research hybrid bridge structures with steel and concrete.

The Technical Laboratories have three wind tunnels, the large boundary layer wind tunnel (width 4.5 m, height 2.5 m), the multi-purpose boundary layer wind tunnel (width 2.5 m, height 2.0 m) and the flow visualization wind tunnel (width 2.0 m, height 1.2 m), which have been used primarily for advancing research of wind effects on superhigh-rise buildings. Now these wind tunnels can be used for tests on both building structures and civil engineering structures.

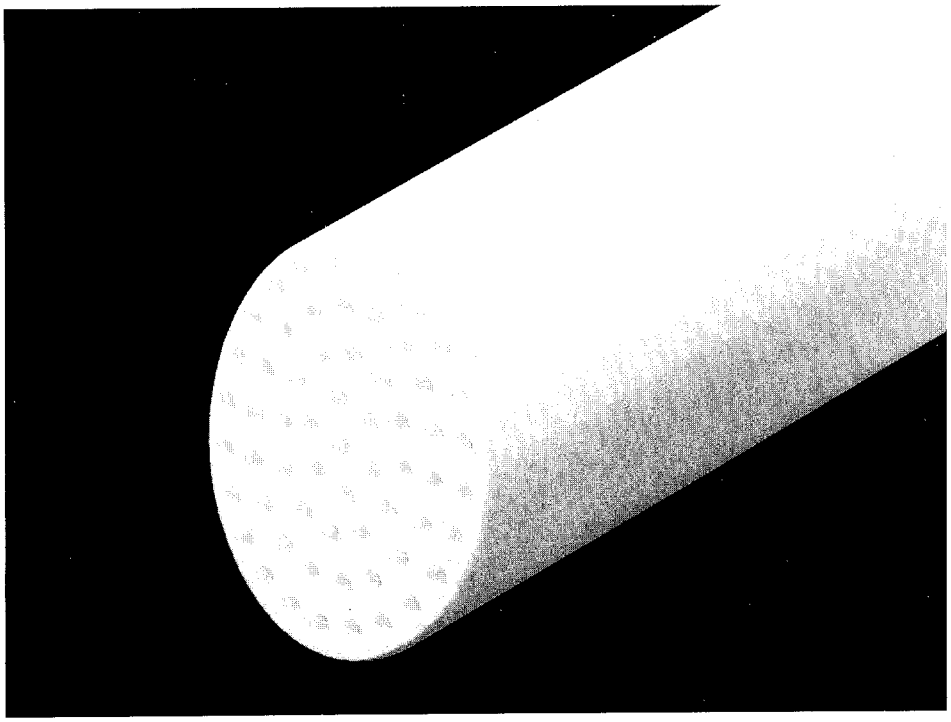
The model testing system is installed in the multi-purpose wind tunnel. The bridge section by winds are measured to acquire aerodynamic stabilities of the bridge. Wind forces can also measured with load gauges. The air flow around vibrating structures can be seen (to clarify the mechanisms of the vibration) using the vibration generator of the flow visualization wind tunnel.



Bridge section model test facility

* ***Kajima Corporation***
Public Relations Office
1-2-7, Motoakasaka, Minato-ku, Tokyo 107
Tel: +81-3-3746-7040
Fax: +81-3-5474-9497

Water Treatment System Using Ceramic Membrane Filter



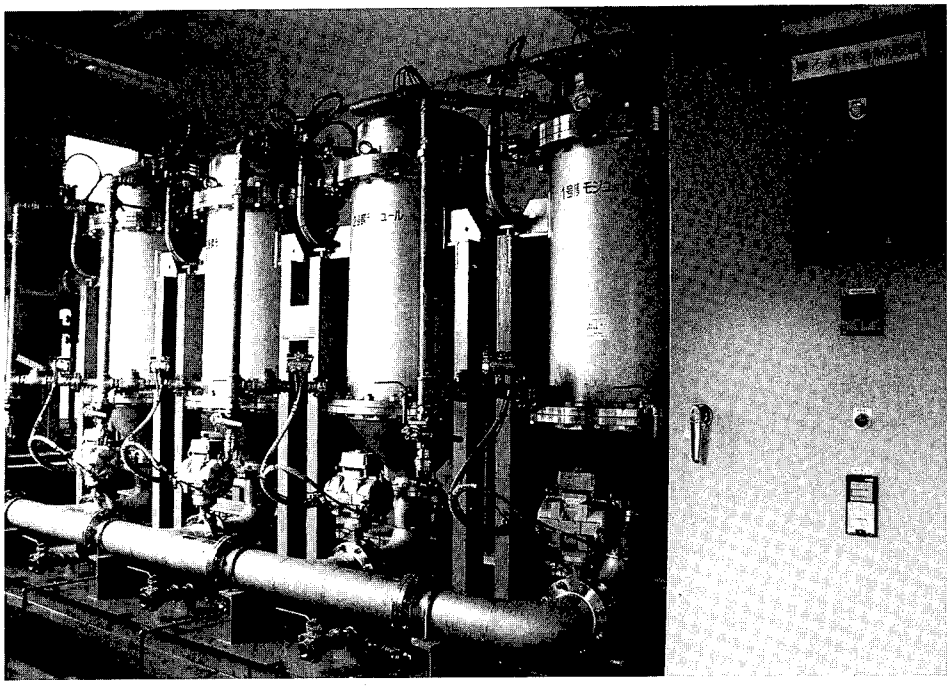
Sectional view of ceramic membrane filter

NGK Insulators, Ltd. has developed a water treatment system that uses a ceramic membrane filter. This system is now applied at medium and small size water treatment plants. The first commercial plant has started operating in Kyoto. The nominal pore size of membrane is 0.1μm; therefore, suspended solids, such as chlorine resistant bacteria and colibacillus bigger than this pore size, can be separated and removed.

This is the first simplified water treatment system using a ceramic membrane filter to provide drinking water for approximately 1000 persons daily. In the water treatment plant in Kyoto, four units of filtration modules are installed. Each unit mounts 150 monolith type ceramic filtration elements, resembling the lotus root, with a length of 100 cm and diameter of 3 cm. Each element has 61 holes with an inner diameter of 2.5 mm. The total membrane area of the four units is 288 m2. The daily water purification capacity is 426.6m^3.

The filtration membrane features excellent filtration reliability and corrosion resistance. Membrane replacement takes place once in about 12 years, and the system is operable with ease and at a low running cost. It is much more compact than conventional types of slow filtration facilities. In addition, due to backwash using filtrate and compressed air, the system is operable continuously for 6-12 hrs, and the purified water recovery ratio high as about 99%.

* ***NGK Insulators, Ltd.***
Public Relations Office
2-56, Suda-cho, Mizuho-ku, Nagoya City, Aichi Pref. 467
Tel: +81-52-872-7181
Fax: +81-52-872-7690



Ceramic membrane filter modules

NATIONAL R&D PROJECTS

This section describes various R&D projects being carried out in Japan on a national scale.

* ***Agency of Industrial Science and Thechnology, MITI***
New Sunshine Project Promotion Headquarters
1-3-1, Kasumigaseki, Chiyoda-ku, Tokyo 100
Tel: 81-3-3501-1511
Fax: 81-3-3501-7928

Recent Changes in the Development of Energy- and Environment-Related Technologies

1. In conformance with the Basic Science and Technology Program (endorsed by the Diet in July 1996) and the Program of Action for Economic Structure Revision and Creation (endorsed by the Diet in May 1997), the fields relating to energy and environment must give priority to supporting and expanding all activities from basic technology research and development to the development of various industrialization promotion technologies for identifying and fostering new technological seeds capable of contributing effectively to the creation of new industries.
2. Japan must assume active leadership in order for the world to attain the numerical objectives to be agreed upon internationally at the Third Conference of Countries Participating in the Meteorological Change Framework Treaty (COP 3) to be held in December this year, so there is an urgent need for Japan to commercialize and promote the wide application of advanced energy- and environment-related technologies as soon as possible.
3. In view of this situation, Japan, while contributing to the creation of new industries, must cope with the changing situation by accelerating the development of energy conservation technologies applicable to all fields of industry, public life and transportation due to the importance of CO2 emission suppression, economic growth promotion, securing of energy supply and demand with stability and the attainment of balanced world growth, while engaging in the development of technologies relating to new energy resources and in the development of innovative technologies from the medium- and long-term perspective.

New Sunshine Program in Fiscal Year 1998

In FY 1998, the basic plan of the New Sunshine Program is to advance the development of energy and environment domain technologies efficiently and systematically despite the severe financial situation, and simultaneously to contribute to the creation of new industries and to cope with the COP 3 issues in the face of the stringent national financial situation. (Regarding the independent budgets for projects, refer to separately appended reference data.)

Regarding project implementation, in view of the interim report On the Future Course of the New Sunshine Program submitted by the Energy and Environment Technology Development Subcommittee of the Industrial Technology Inquiry Board in August 1996 (* 1), the Agency of Industrial Science and Technology in January this year decided to implement its projects in conformance with the basic plan for system revision relating to future R&D projects (On the Implementation of System Revision in the New Sunshine Program) (* 2), and is implementing its projects from FY 1997 along these lines.

(* 1) The following points were recommended as the basic directions for reassessing the New Sunshine Program in the interim report On the Future Course of the New Sunshine Program submitted on August 28, 1996:

* Carrying out the R&D strategy in conformance with the long-term, extra-long-term perspective.
* Substantiation of research relating to the creation of technical seeds leading to innovative technologies.
* Bolstering the various R&D schemes in conformance with the R&D stages, etc.
* Bolstering a transparent system for evaluating the setup for implementing and administering projects efficiently.
* Transferring the R&D results openly and internationally.

(* 2) The specific contents of system revision in conformance with the report On the Implementation of System Revision in the New Sunshine Program (January 1997) are as follows:

* The R&D periods shall in principle be within 5 years.
* Two R&D systems shall be adopted, the integrated administrative type (integrated R&D system under leaders) system and the scope type (competitive R&D type) system.
* Enforcement of rigid evaluation system as by appointing external experts (see note).
* Stimulation of the need for outstanding results by offering priority implementation rights to research organizations.

(Note:) The Technology Evaluation Guidelines of the Ministry of International Trade and Industry were announced in August this year (Ministry of International Trade and Industry Notification No. 474)

1. Continued Implementation of Existing Projects

Since FY 1993, R&D has been advanced in coordination to develop innovative technologies in connection with new energy resources, energy conservation and global environment preservation. Emphasis has been given primarily to the development of photovoltaic power generation systems and advanced battery power storage systems (high-performance lithium secondary batteries), and R&D projects have been advanced on integrated and coordinated technologies including the international clean system technology for hydrogen utilization (World Energy Network = WE-NET) and wide-area energy utilization network system (ECO Energy City Network System).

1. Development of Photovoltaic Power Generation System
   The target is the development of low-cost, high-speed and high-efficiency module mass production technologies using amorphous solar cells.
2. Development of Advanced Battery Power Storage System
   The aim is to develop technologies relating to lithium secondary batteries applicable to electric vehicles (EV) and home power storage systems.
3. Advancement of Project to Develop International Clean System Technology for Hydrogen Utilization (WE-NET)
   Development of technologies for the conceptual designing of overall systems for hydrogen energy utilization, hydrogen manufacture and hydrogen transportation.
4. Advancement of Research to Develop Elementary Technologies for Energy Storage and Utilization in Various Fields of Industry
5. Development of Wide-Area Energy Utilization System (ECO Energy City Network System)

   Intensification of research to achieve breakthroughs in the development of technologies relating to various fields in connection with energy recovery, transformation and transportation, with city and peripheral industrial facilities in perspective.

2. Implementation of New Projects

Regarding new projects, the following two themes were adopted subsequent to the preliminary evaluations conducted by the Planning and Systems Committee, Energy and Environmental Technology Development Sectional Meeting, Industrial Technology Inquiry Association. Also, regarding the precursory research system established in FY 1997, the following two themes were adopted through the same evaluation process. In FY 1998, the plan is to implement these new projects and precursory R&D projects.

[New Projects]

1. Development of Superconductance-Applied Basic Technologies
   Research will be advanced to commercialize high-temperature superconductance wires and devices to improve the efficiencies of power system stabilization facilities and equipment.
2. Development of Ultralow Loss Power Devices
   Research will be advanced to develop ultralow loss, high-speed power devices made of silicon carbide (SiC).

[New Precursory R&D Projects]

1. Basic Precursory Research on AC Superconducting Power Equipment
   Precursory R&D projects will be advanced to develop technologies to evaluate the energy conservation effects of AC superconducting power equipment and the stability improvement effects of power systems.
2. Precursory Research on MGC Ultrahigh-Efficiency Turbine System Technology
   Precursory R&D projects will be advanced to develop a turbine system using MGC materials (molten growth composite materials) whose strengths are not deteriorated up to 1,800 °C.

3. Advancement of Research to Develop Revolutionary Global Environment Preservation Technologies

Breakthroughs with innovative technologies will be necessary in order to fundamentally resolve global meteorological change issues, so research will be intensified to develop technologies enabling the fixation and effective utilization of CO^2.

1. Development of Technologies to Forecast the Environmental Influences Accompanying Marine CO^2 Isolation
   Research will be advanced to develop technologies to evaluate the CO^2 isolation capacities of the seas, and technologies to forecast the environmental influences exerted on CO^2 release points and their peripheral regions.
2. Development of Environmentally Harmonized Type Catalysts
   Basic technologies will be developed systematically in connection with catalysts to suppress the generation of the global hothouse effect gases, and technologies for the fixation of these gases.

4. Advancement of Research to Develop Immediate-Effect Energy- and Environment-Related Technologies (in Conformance with COP 3 and in Relation to the Creation of 15 Fields of New Industries)

Accelerating the development of technologies for energy conservation in all sectors of industry, civilian living and transportation will have the vital effect of hastening the fruitful completion of existing technology development projects, for which it will be necessary to advance new R&D projects to develop advanced immediate-effect energy- and environment-related technologies.

1. Development of Immediate-Effect, Innovative Energy- and Environment-Related Technologies
   To resolve global environmental issues such as global warming, research will be advanced to develop immediate-effect energy- and environment-related technologies which can be anticipated to provide immediate and effective results.
2. Expansion of System to Encourage Promising New Industry Creation Proposals
   Efforts will be continued and expanded to encourage promising new industry creation type proposals relating to the domains of energy and environment.

5. Advancement of Research to Develop Technologies to Realize An Environmentally Harmonized Type Economy and Society (Development of Technologies Relating to New Recycled Products)

To respond to urgent social environmental issues such as resources recovery and recycling, research will be advanced to develop immediate-effect environment-related technologies which can be expected to provide immediate and effective results.

1. Research to Develop Innovative Immediate-Effect Environment-Related Technologies (Related to Economic Structure Revision Special Adjustment Measure)

In FY 1998, the plan is to promote the development of technologies conducive to these recycling systems since social demand is rising for the recovery and recycling of substances such as waste glass and used paper.

(6) Promotion of Research Cooperation with Developing Countries (In Connection with ODA)

In order to reflect the results of R&D of the New Sunshine Program to research cooperation with developing countries, research cooperation with Indonesia in connection with the small-scale geothermal energy resources prospecting project that was started in FY 1997 will be continued.

Table of FY 1998 Budget Demands for the New Sunshine Program

(Unit: ¥1 Million)

	FY 1997 Budget	FY1998 Budget Demand
New Sunshine Program Total	**56,320**	**59,013**
(Re: Energy)		
(1) Solar energy technologies (including solar systems)	7,263	7,667
(2) Geothermal energy technologies	3,123	2,692
(3) Wind power energy technologies	476	411
(4) Coal energy technologies (liquefaction, hydro-gasification)	10,639	9,257
(5) Fuel cell power generation technology	5,480	4,610
(6) Ceramic gas turbine	1,965	1,324
(7) Superconductance and other applied power technologies	2,728	2,110
(8) Superconductance-applied basic technologies (new technologies)	0	2,501
(9) Distributed type battery power storage technologies	2,104	3,010
(10) Wide-area energy utilization network system technologies (ECO energy city project)	1,630	1,711
(11) Hydrogen utilization international clean energy system technologies (WE-NET)	2,231	2,286
(12) Ultralow loss power devices technologies (new technologies)	0	320
(13) Precursory research and development (AC superconducting power equipment basic technologies, MGC ultrahigh-efficiency turbine system technologies (new technologies)	300	477
(14) Immediate-effect, innovative energy- and environment-related technologies (new technologies)	0	1,600
(15) Others	6,753	6,581
(Re: Environment)		
(1) Global environment-related industrial technologies	9,628	9,756
(2) Immediate-effect, innovative environment-related technologies (new technologies) (Development of technologies as in connection with new recycled products)	0	300
System for Enlistment of New Industry Creation Proposals (Domain of energy- and environment-related technologies)	**4,700**	**5,454**
Research Cooperation to Prospect for Small-Scale Geothermal Power Generation Possibilities in Remotely Isolated Islands (ODA Technical Cooperation)	14	83

(The totals may not agree since the figures are given to the nearest integer values.)

GENERIC TECHNOLOGY REVIEW

This section describes various basic research and development activities in Japan to inform the world about generic R&D efforts here.

Synthesis of Inorganic Mesoporous Materials for Application to Chemical Reactions

Special Mining Industry Research Project: Creation and Evaluation of New Functions by Simultaneously Controlling the Modes and Structures of Particle Systems

* *Agency of Industrial Science and Technology, MITI*
Research Administration Division
1-3-1, Kasumigaseki, Chiyoda-ku, Tokyo
Tel: +81-3-3501-1777
Fax: +81-3-3501-7899

Synthesis of Inorganic Mesoporous Materials for Application to Chemical Reactions

The National Industrial Research Institute of Nagoya

Project Backdrop

The National Industrial Research Institute of Nagoya earlier showed through its vital regional technology R&D project, Synthesis of Artificial Clay for High-Performance Ceramics, that the chemical reaction of clayey particles occurs not on the atomic level but on the molecular level. The institute is striving to elucidate the mechanism of formation of ultra-fine hollow spherical silicate particles of few nanometers diameter through its interdisciplinary research project to establish a Technology for High-Purity Synthesis of Ultra-Fine Particles in the Earth's Surface Layer.

Research on the photochemical reactions of molecules enclosed in nanometer spatial confines, such as micelles, is being advanced as a link of the Integrated Science and Technology Promotion R&D Project Study on Methods to Prepare Spin-Sensing Materials. In particular, for reactions which involve the radical pair process, a new reaction control theory is being proposed, or specifically a reaction control technique based on spin manipulation. In addition, the structures of ceramics are being evaluated through high-resolution solid-state nuclear magnetic resonance (NMR) studies.

The present project will study methods for synthesizing inorganic mesoporous materials as highly efficient promoters for reactions, and to study methods for measuring and controlling these reactions, based on the results of these previous R&D projects.

Objectives of Research

Natural minerals and inorganic compounds are used widely today as ceramics materials, but new materials will have to be identified to establish technologies essential for next-generation industries. In this research project, the objectives are firstly to synthesize large inorganic molecules of meso sizes while controlling their shapes and sizes in integration, and further to arrange these molecules neatly in a regular structure. By selecting and controlling the arrangements of these large inorganic molecules, materials will be synthesized which possess meso-pores with the shapes are controlled very accurately. Organic molecules of low molecular weights will be incorporated at the pore centers to cause photochemical reaction in the meso-pore domain, so establishing a reaction control technique utilizing a magnetic field and featuring excellent reaction selectivity.

Contents of Research

Synthesis of silicate macromolecules (tubular, spherical and lamellar) and affinitive compounds will be attempted by the hydrothermal method as well as sol-gel method and co-precipitation method. In this research project, the aim is to elucidate the mechanism of reactions of atom groups as the minimal unit of reaction and to establish a reaction control technology.

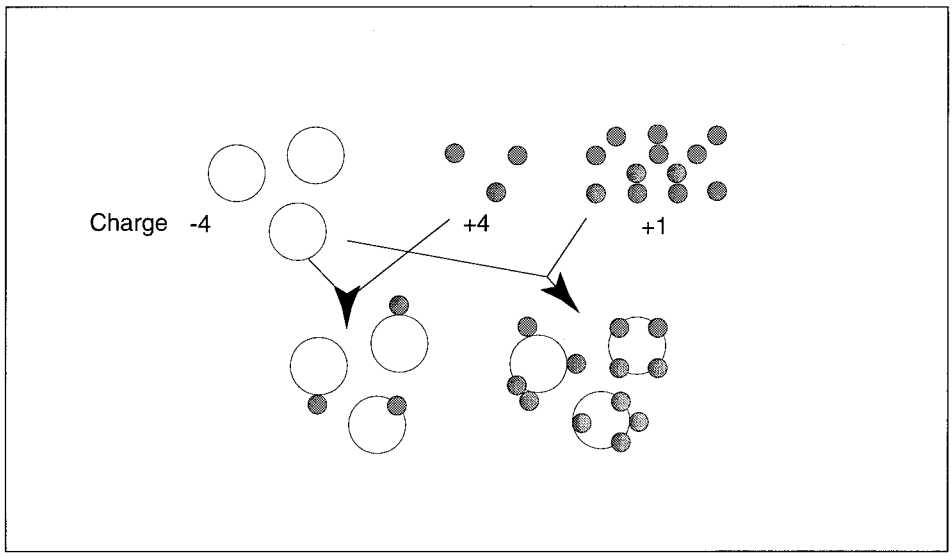
The arrangements of the obtained inorganic macromolecules will be studied. The sedimentation method and surfactant method will be applied to synthesize porous array groups with optional shapes and pore sizes of 1-10 nm. Further, organic molecules will be implanted inside the obtained mesoscopic materials to observe the characteristics of photochemical and radioactive chemical reactions. Ultimately, studies will be advanced on the application of reaction-controlling materials and environmentally adjusting materials by utilizing their meso-pore sizes.

Special Mining Industry Research Project: Creation and Evaluation of New Functions by Simultaneously Controlling the Modes and Structures of Particle Systems

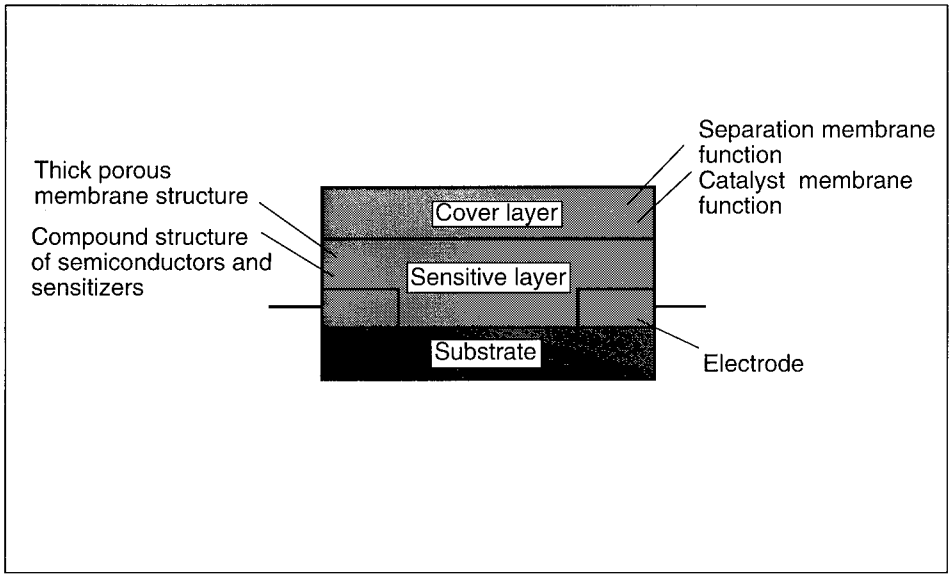
The National Industrial Research Institute of Nagoya

Currently, there are stringent demands for the sophistication of the characteristics and structural control of materials, so research is being conducted widely to improve the characteristics of materials by controlling the microstructures of bulk materials including the compounding of crystal structures. However, research has only started in connection with projects which use particles as the starting materials and which link structural control to improving material characteristics, or research to improve material characteristics not through the control of independent factors such as particle modes and particle microstructures but rather through integrated (simultaneous) control of these factors.

In this new project, the objective is to establish a process technology to control the external modes such as the compounding of the surfaces of particles and particle systems represented by particle groups (thick membranes or bulk materials) which give shapes to particles, as well as to simultaneously control the internal structures or the inside structures of particles. Another objective is to develop a function evaluation system. Through these research activities, the characteristics will be improved and new functions created of industrial materials using starting-out materials of particle systems with accurately controlled modes and structures. Further, the expertise acquired in the process of these research activities will be applied to the standardization of chemical specimens.



Synthesis of Composite Particles by Electrostatic Coagulation Method.



Typical Structure of Semiconductor Gas Sensor

The method of advancing this project may be summarized as follows. A previous research project has developed an aerosol process that enables quantitative control of the number of auxiliary component particles adhering on the surfaces of core particles, for application as the method for manufacturing accurately controlled composite particles (electrostatic coagulation method). This method enables the control of the amount of auxiliary particle adherence to the surface of a core particle as shown in Fig. 1. In this new project, this technology is applied to control the compound structures of the semiconductor sensitizers of semiconductor gas sensors with the structure shown in Fig. 2, and efforts are being made to manufacture semiconductor gas sensor elements with sensitizers controlled quantitatively. Further, research is in progress to establish improvement technologies through particle compounding by the aerosol process to improve characteristics such as the sensitivity through the control of the thick porous structures of sensitive layers as well as to incorporate the functions of simultaneous sensing of several types of gases and of treating toxic gases.

This project aims to establish technologies for the improvement of characteristics of material systems utilized in particle mode such as catalysts, and materials including bulk materials of which the raw material powder state largely influences the microstructures of these materials. The expertise acquired during the process is anticipated to contribute to the progress of particle synthesis processes, and to enable neat arrangement of standard chemical substances through an evaluation of uniform particle systems.

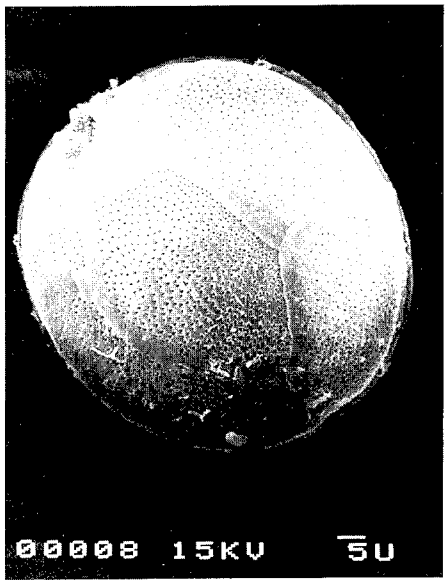
97-11-100-01

New Technique to Analyze Natural Organic Compounds

Assoc. Prof. M. Murata, Dr. N Matsumori, Prof. K. Tachibana and their research team of the School of Science, the University of Tokyo, have established a new technique to analyze the stereochemical orientation of natural organic compounds.

Identification and utilization of natural organic substances as drugs requires both analysis of the chemical formula and the stereochemical structure including the asymmetric chiral centers which determine the interactions of substances with receptors or biopolymers. The new technique enables the correlation of adjacent asymmetric carbons to be determined with ease by nuclear magnetic resonance (NMR) spectroscopy and is certain to substantially improve the efficiency of research on new bioactive substances.

Up till now, to investigate the stereochemical correlation of adjacent asymmetrical carbons, the NMR method was employed to measure the spin coupling constants of the hydrogens bonded to the asymmetrical carbons and to elucidate their relative orientation. However, the NMR technique lacked the necessary accuracy and was unsuitable for elucidating the orientation between hydrogen and carbon or between hydrogen and oxygen.



Gambierdiscus toxicus

The new technique utilizes the improved performance of the NMR technique and investigates not only the hydrogen atoms which are bonded on the aligned asymmetrical carbons but also investigates the correlation between hydrogen and carbon, allowing identification of the stereochemical orientation of asymmetrical carbons. Although there are some cases in which identification is impossible simply by this method, a separate technique can be combined to determine the stereochemistry.

Up till now, when investigating the correlations of asymmetrical carbons, a substance was synthesized with the possible structure and the characteristics compared to determine the actual structure. In this case, long continuous chains have to be investigated independently in shorter blocks, but if five asymmetrical carbons are linked together, it was necessary to produce blocks as many as 2^5 blocks.

The research team actually identified a compound produced by a certain species of algae. Normally, if the method of actual synthesis is adopted to a structure consisting of about 70 carbons, this would require a period of more than five years, but with the new technique, most of the structure was identified in a few months from the time the sample was acquired. This new technique is not applicable in the event there are no adjacent asymmetrical carbons, but in this case the synthesis technique can be applied to clearly identify the asymmetrical centers individually.

* ***The University of Tokyo***
Dept. of Chemistry, School of Science
7-3-1, Hongo, Bunkyo-ku, Tokyo 113
Tel: +81-3-3812-2111 ext 4357
Fax: +81-3-5800-6898

97-11-100-02

Photoconductive Semiconductors Manufactured Rapidly in Microgravity Environment

Hokkaido National Industrial Research Institute (HNIRI) has succeeded in manufacturing high-performance photoconductive semiconductors by synthesizing the raw materials in a low-gravity environment. The institute used a drop tower that is 10 m tall and synthesized photoconductive semiconductors as rapidly as in 1.2 s. Photoconductive semiconductors of excellent photoconductive absorption characteristics were produced, which are anticipated to be applicable to the manufacture of infrared ray photoconductive sensors. These experiments corroborated that a drop facility with a microgravity environment is amply applicable as an industrial means for producing electronic materials.

The experiments were conducted by using indium-antimony, the drop container was an ultrahigh-vacuum processing chamber, and rapid heating and rapid cooling were performed in a vacuum environment of 10^{-8} atm. To prevent material vaporization and infiltration of impurities into the material, a semiclosed tube process was used. The raw materials were packed inside a tube made of crystal, and dropped in the vacuum environment.

In an environment of micro gravitational force, the raw materials are maintained in safe condition without contact with the container walls, and maintained in a state of supercooling with the cooling process. Subsequently, the coagulation speed is increased rapidly by the concussion to promote monocrystallization most effectively. The diameters of the monocrystallines are about 5 mm, about 100 times larger than usual. The absorption characteristic of light for converting infrared radiation into electricity was 40% higher than that of standard types of crystal materials.

The energy band gap, the measure of reaction of infrared ray wavelengths, was also observed to undergo a change depending on the raw material composition ratio. A bright outlook has been acquired to develop infrared ray sensors of different wavelengths, which is certain to expand the range of utilization of electronic materials.

* ***Hokkaido National Industrial Research Institute (HNIRI)***
Research Planning Div.
17-2-1, 2-Jo, Tsukisamu-higashi,
Toyohira-ku, Sapporo, Hokkaido 062
Tel: +81-11-857-8402
Fax: +81-11-857-8901

97-11-100-03

High-Sensitivity Technology for Saccharide Chain Analysis

A joint research team belonging to the Tokyo Metropolitan Institute of Gerontology and the Tokyo Metropolitan Institute of Clinical Medical Science has established a high-sensitivity technology for analyzing substances (saccharide chains) present on the cell surfaces of which are deeply involved in cancer generation and virus infection.

With the new technology, saccharide chains consisting of various types of mono saccharides such as glucose are labeled with a fluorescent substance, and their masses measured with a mass spectroscope to investigate the structures of the original saccharide chains. In the experiments conducted to analyze saccharide structures of glycoproteins, it was possible to identify a specific type of saccharide even from samples as small as 10 fmol.

Up till now, gel filtration was used for saccharide chain analysis, and the mass was determined by measuring the periods of time required to pass through the column filled with small particles . Therefore, at least 10 pmol of specimen had been necessary. In addition, the new technique requires only a few minutes for accomplishing the measurement, which is only about a hundredth part of the time required by the conventional method.

Saccharide chains consist of several types of sugars, and are present on the surfaces of cells and act as markers for recognition among cells. Cancer cells and virus infections are influenced by the structures of these saccharide chains, so the establishment of this technology for high-sensitivity analysis of saccharide chains is anticipated to improve medical diagnosis accuracy substantially.

* ***Tokyo Metropolitan Institute of Gerontology***
35-2, Sakae-cho, Itabashi-ku, Tokyo, 173
Tel: +81-3-3964-3241
Fax: +81-3-3579-4776

97-11-100-04

Porous Ceramic Membrane with One Dimensional Nanosize Porosity

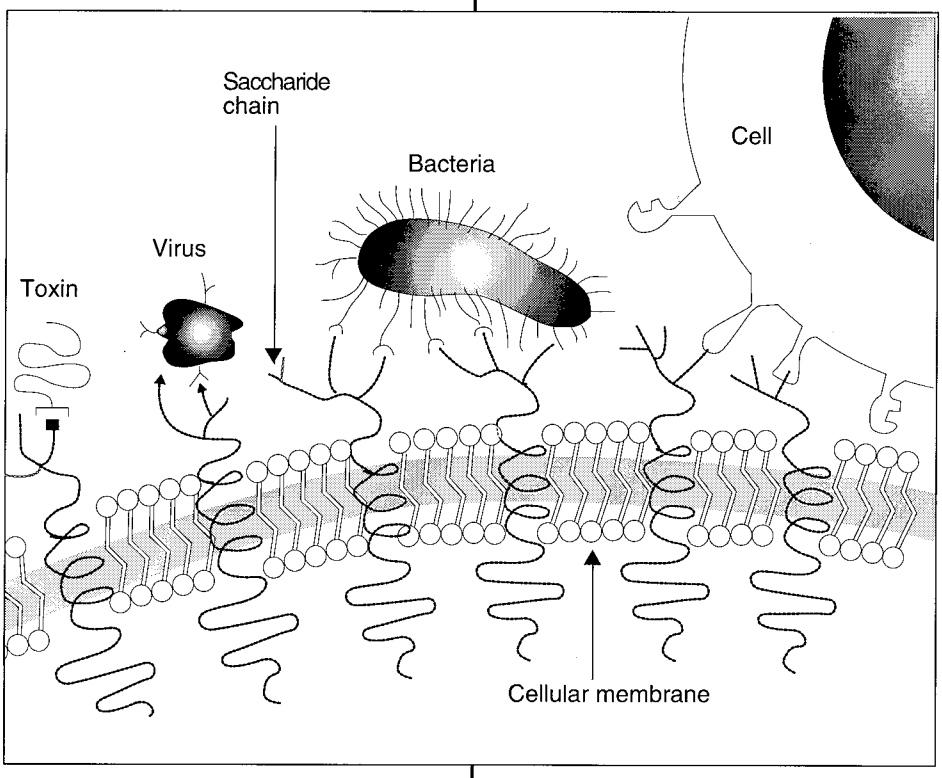
Prof. S. Hirano and his research team of the Synergy Ceramics Research Laboratory have succeeded in developing a porous ceramic membrane with regularly aligned nanometer-size air permeation pores.

A porous ceramic membrane with numerous nanosize one dimensional pores penetrating the membrane has various applications including the separation of molecules and ultrafine particles present in high-temperature waste gases as well as for producing highly active catalysts and high-temperature catalyst carriers for chemical plants. The new membrane was developed by applying a new manufacturing technique called the eutectic decomposition process.

In experiments, an amorphous membrane consisting of iron, silicon and oxygen was produced on a silica glass substrate by the sputtering process. When this membrane was heat treated at 600 °C, the 4-nm diameter hematite crystals with the elongated one-dimensional form were precipitated in the silica matrix by the eutectic decomposition reaction.

When the membrane was soaked in a hydrochloric acid aqueous solution, the hematite was leached out by dissolving with hydrochloric acid and the membrane converted into a porous membrane with one dimensional pores of 4 nm diameter. This silica membrane underwent no structure change even when heated for 2 hours at 600 °C, and its specific surface area was over 1,000 m^2/g. Therefore, this membrane can be applied to producing separation membranes, catalysts and catalyst carriers, also for creating new types of functional materials by including heterogenous substances in the membrane pores, and can also be applied to the creation of other types of ceramic materials by precursor design.

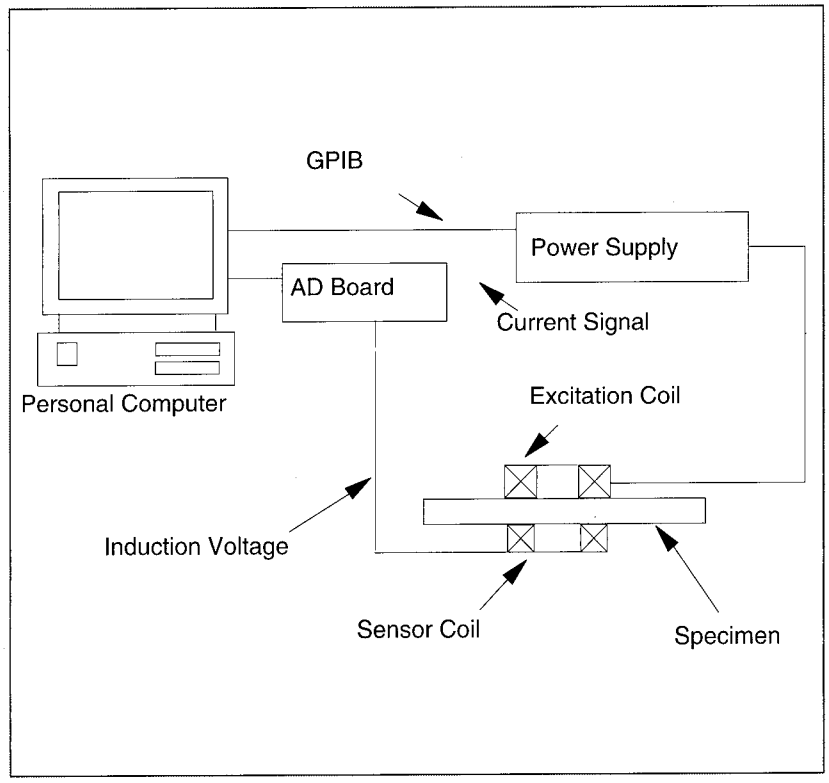
* ***Synergy Ceramics Research Laboratory***
2-4-1, Mutsuno-cho, Atsuta-ku, Nagoya City, Aichi Pref. 456
Tel: +81-52-87-8815
Fax: +81-52-871-8826



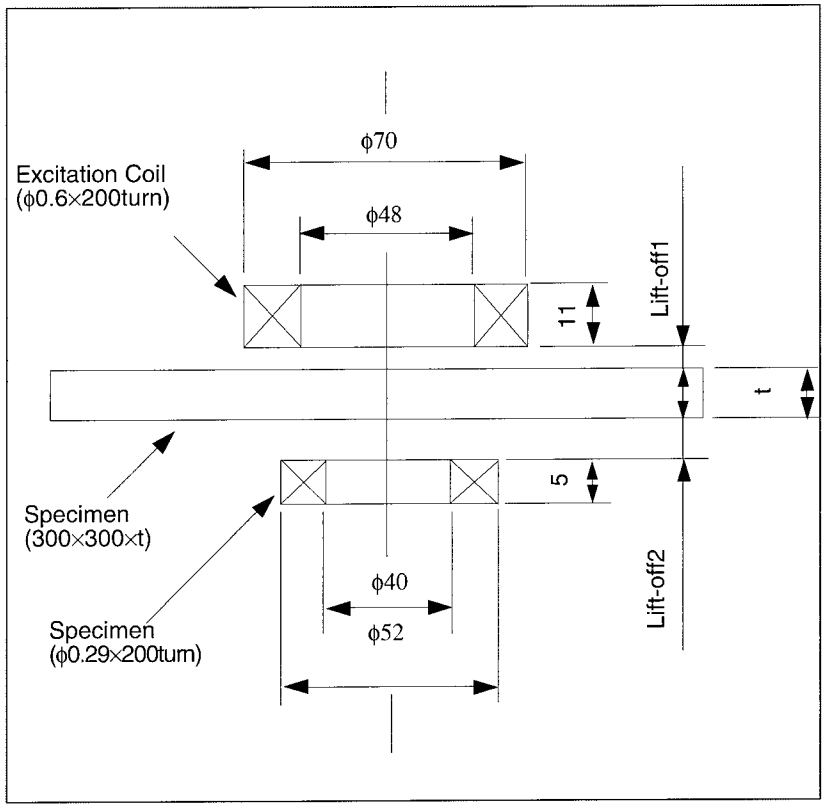
97-11-100-05

Steel Thickness Measurement by Electromagnetic Method

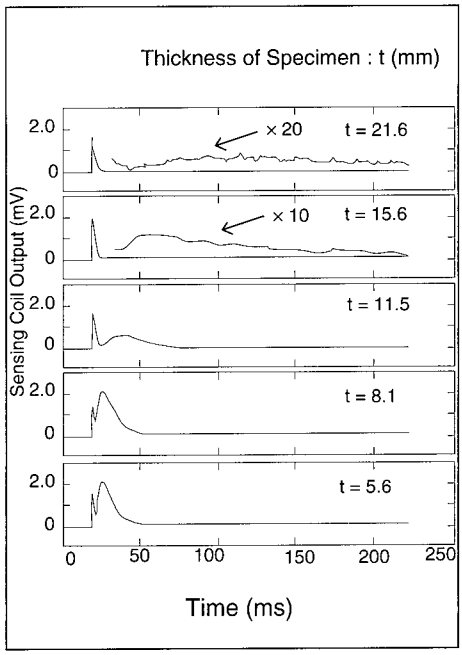
The Ship Research Institute of the Ministry of Transport has established a method to measure the thicknesses of steel plates with ease even if they are corroded. With this new method, the steel plate is sandwiched with two coils and a terraced electric current passed through one of the coils to generate a magnetic field. The phenomenon of a current being generated in the other coil by electromagnetic induction



Block diagram of the experiment



Configuration and dimensions of specimen, excitation coil and sensor coil



Waveforms of sensor coil output from the experiment

when the magnetic field penetrates the steel plate is utilized to deduce the plate thickness from the peak waveform of the generated current.

In experiments, the peak waveform characteristics and time delay underwent changes in conformance with the plate thickness, and it was confirmed that the new method is applicable to measuring steel plates with thicknesses of over 1 cm which are used as the structural members of ships and marine structures.

When measuring the thicknesses of easily corroded ship steel plates, the conventional method of passing weak oscillations through the steel plate and detecting the reflected waves used to require much time and labor since the rusted parts had to be removed prior to conducting the measurements. In this respect, the new method enables non-contact measurements to be made, and while the measurement accuracy is slightly inferior than that of the conventional method, it is adequate since simply measuring a safe thickness is all that is necessary when working with ships.

* ***The Ship Research Institute of the Ministry of Transport***
6-38-1, Shinkawa, Mitaka City, Tokyo 181
Tel: +81-422-41-3109
Fax: +81-422-41-3112

NEW TECHNOLOGY & PRODUCTS

This section provides information about recently developed technologies and products, divided into Advanced Materials, Electronics & Optics, Information & Communications, Process & Production Engineering, Construction & Transportation, Energy, Environment, and Biotechnology & Medical Science.

Advanced Materials

97-11-001-01
Mass Production of Ductile Castings Permitting Welding with Iron

Asada Katan Chutetsu-sho, Ltd. has applied the gas process in an electric converter environment to decarbonizing cast iron surfaces, which enables cast iron to be welded with iron in the same method as mild steel. Compared with conventional types of products which are forged, machined and then welded, the new casting process enables manufacturing cost reduction by 30-40%, as well as weight reduction, so can be applied to the manufacture of construction materials and automotive parts.

With the new decarbonization process using an electric converter environment, the composition of a gas consisting of a mixture of propane gas and air is first changed and supplied into the electric converter in the form of carbon dioxide and carbon monoxide. When these gases are treated over a long time at a high temperature exceeding 1,000 °C, the carbon contained in the castings reacts with the converter environment and decarbonization occurs. The problem of surface oxidation was overcome by controlling the converter temperature and period of use as well as by controlling the gas.

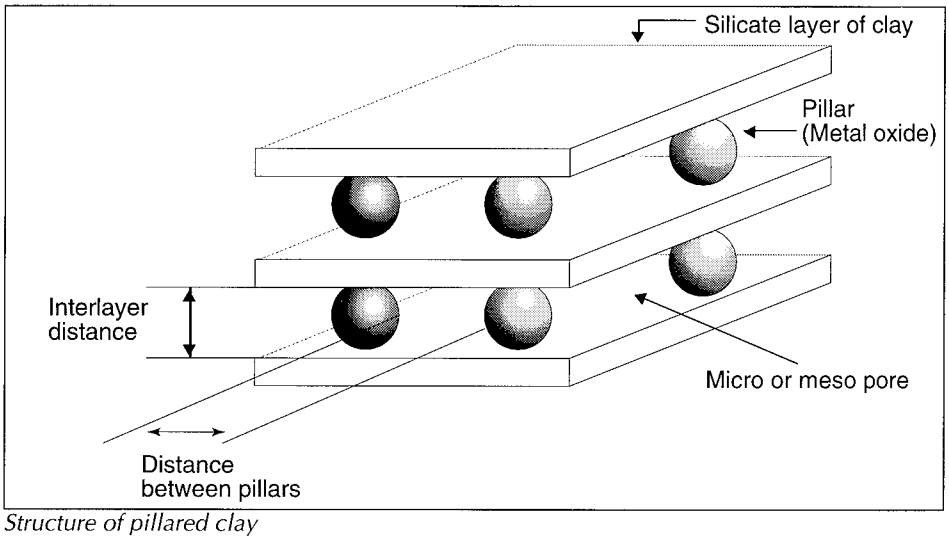
This ductile casting can be welded with iron without preheating and by using ordinary types of welding materials, so cost reduction and weight reduction are possible compared with forgings which are welded after machining.

* ***Asada Katan Chutetsu-sho, Ltd.***
1-29, Osadano-cho, Fukuchiyama City, Kyoto 620
Tel: +81-773-27-2058
Fax: +81-773-27-2207

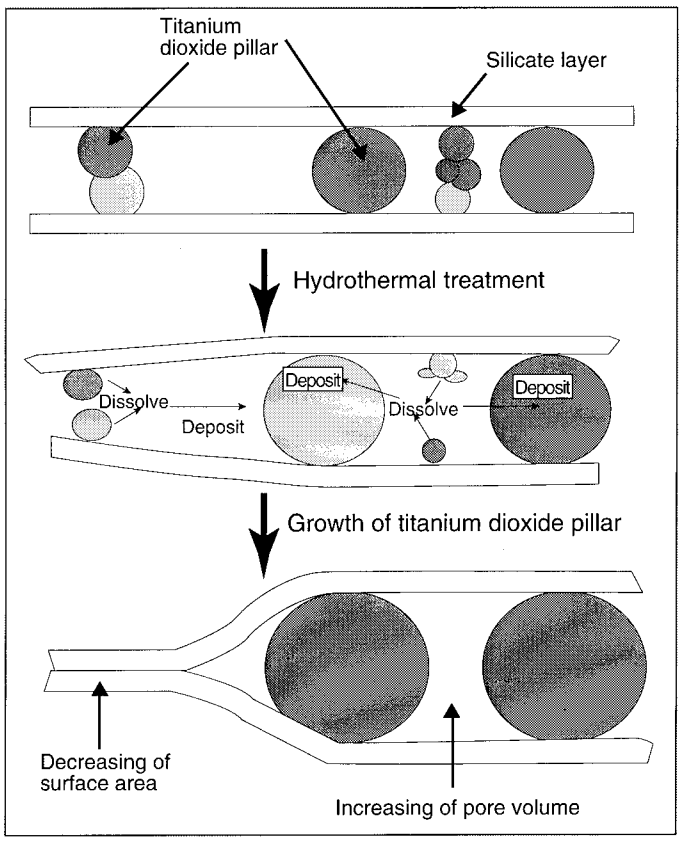
97-11-001-02
Hydrothermal Technology for Manufacturing Titanium Oxide Pillared Clay

The Nagoya Municipal Industrial Research Institute has established a technology to manufacture composite of clay and titanium dioxide of excellent crystallinity. Titanium oxide-pillared clays feature an excellent lamellar crystalline structure, and a technique to manufacture titanium dioxide-pillared clays with fine titanium dioxide particles pillars between their layers has already been developed. However, the titanium dioxide pillars in pillared clays synthesized by this method are amorphous or contain anatase of poor crystallinity, so they show poor photo catalytic activity, and are effused when exposed to acidic solutions. The research institute established a technology to improve the properties of the titanium dioxide-pillared clay, and succeeded in establishing a new technology to improve the crystallinity of titanium dioxide pillars by hydrothermal treatment.

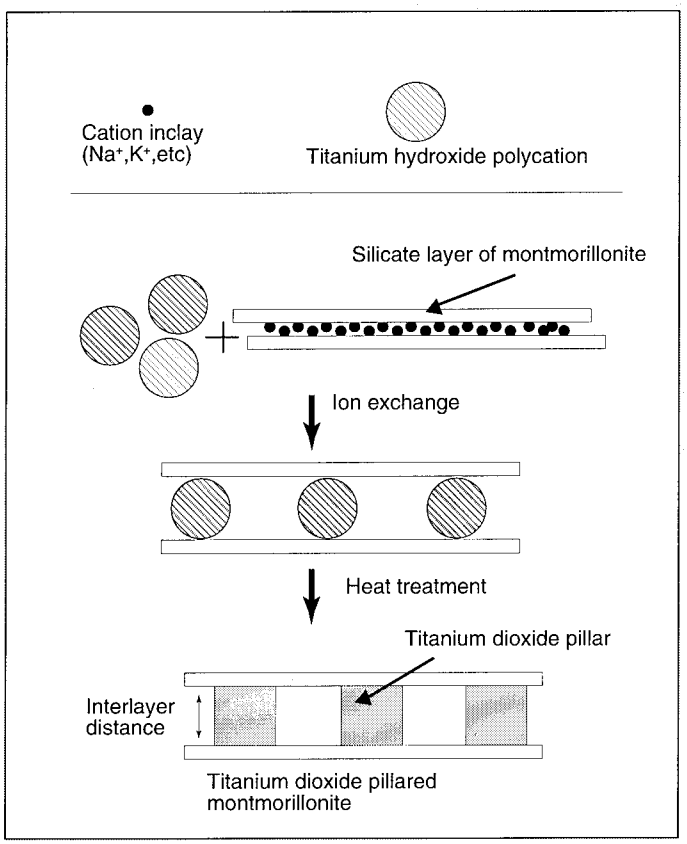
With this new technology, titanium dioxide-pillared montmorillonite prepared by reacting raw material clay was dispersed in solution of titanium hydroxide sol to obtain an aqueous suspension of montmorillonite. The suspension was placed inside a



Structure of pillared clay



Result-example : the growing process of titanium dioxide pillar



Experimental : synthesis of titanium dioxide pillared montmorillonite

sealed container, then heated and given hydrothermal treatment at 160-250 °C. The period of treatment is short at a high temperature, or may require a few days or longer with a lower temperature.

Hydrothermal treatment promotes the crystallization of titanium dioxide pillars to anatase and the growth of titanium dioxide pillars, the lamellar voids are increased and the average pore diameters enlarged, so the specific surface area of the porous complex substance is decreased. In the photo catalytic performance tests decomposing the atmospheric pollutant trichloroethylene, the non-hydrothermal treatment specimen had rate reaction constant of $0.8\times10^{-2}s^{-1}$but the specimen given hydrothermal treatment achieved $1.4\times10^{-2}s^{-1}$, so that the characteristics were improved considerably.

* ***Nagoya Municipal Industrial Research Institute***
3-4-41, Rokuban, Atsuta-ku, Nagoya City, Aichi Pref. 456
Tel: +81-52-661-3161
Fax: +81-52-652-6776

97-11-001-03

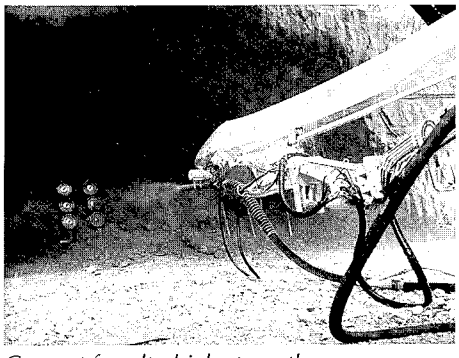
Cement for Ultrahigh-Strength Spray Concrete

Chichibu Onoda Cement Corp. and its subsidiary Onoda Co., Ltd. have jointly developed a new type of cement for use in ultrahigh-strength spray concrete that is ideal for coating the walls of large tunnels.

An outstanding characteristic of the new cement is that its components, aluminum sulfate and gypsum, are adjusted ideally to increase the cement hardening speed. It also has a high fluidity, so when mixing with a quick-setting agent and using in concrete, the concrete can be pumped with ease. The concrete features a strength of 40 N/mm² in 28 days after spraying, about double that of conventional types of high-strength concrete.

The concrete initial-stage strength is high and is retained over a long time, so it will be possible to reduce the sprayed concrete thickness to about two-thirds. The dust normally generated when spraying the concrete is also reduced, so there is minimal unnecessary loss of material. The cost of the cement is increased, but since the sectional areas of tunnels can be reduced by making the walls thinner, the total tunneling project cost will be reduced.

* ***Chichibu Onoda Cement Corporation***
Cement Sales Div.
2-14-1, Nishishinbashi, Minato-ku, Tokyo 105
Tel: +81-5512-5151
Fax: +81-5512-5245



Cement for ultrahigh-strength spray concrete

97-11-001-04

World's Highest Performance High-Temperature Superconducting Sensor

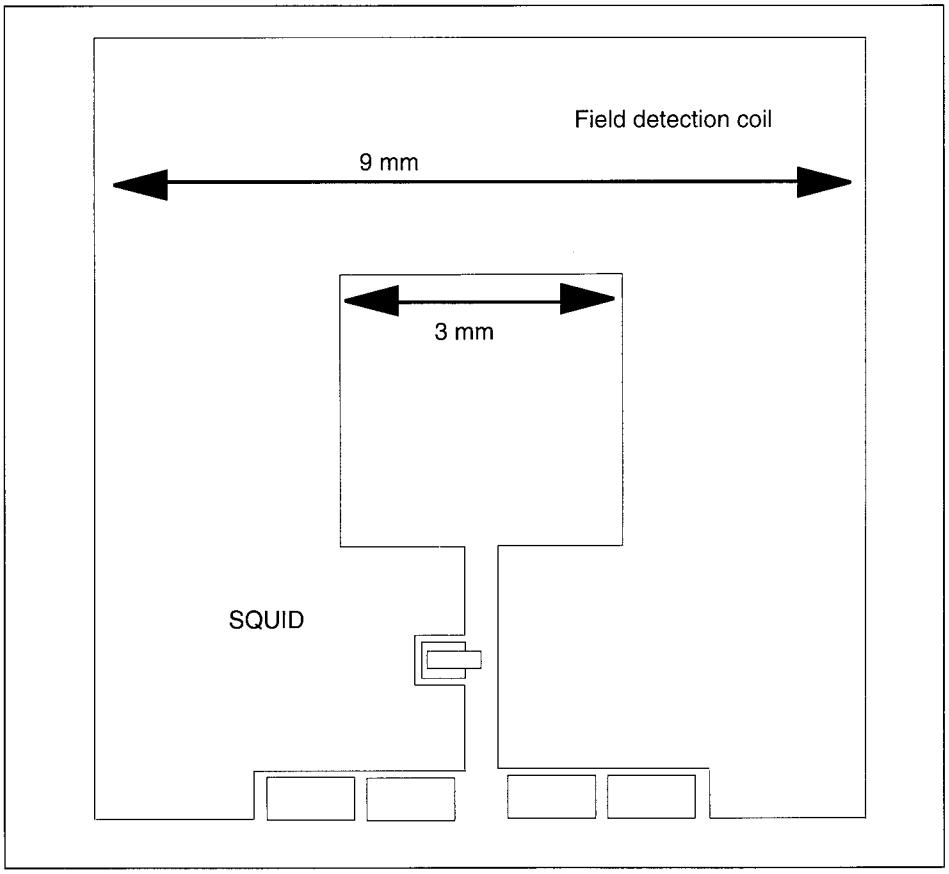
Assoc. Prof. K. Enpuku of the Department of Electronic Device Engineering, Kyushu University, has developed the world's highest performance high-temperature superconducting quantum interference device (SQUID) sensor, in collaboration with Physikalische-Technische Bundesanstalt (PTB) Berlin, Germany.

The sensor magnetic field resolution is 32 fT, a performance that is 2-3 times better than conventional types of SQUID sensors using liquefied nitrogen. Due to the introduction of optimum design and high-performance Josephson junction techniques, the sensor performance as well as regeneration capability have been improved substantically to enable the sensor to be used in medical science and industrial applications.

To realize the high-performance design, the research team optimized the device parameters and attained a resistance of about 10 ohm at the Josephson junction and a critical current of about 20 μA, and an inductance of 50-150 pico-henry. A bicrystal bonding technique was established that replaces the usual inclination of 24 and 36.8 degrees with an inclination of 30 degrees.

As a result, the high-temperature superconducting SQUID sensor has improved the terrestrial magnetism resolution from one part of 300 million to one part of one billion. Compared with the SQUID sensor using liquefied helium, the resolutions is inferior, but it uses low-cost liquefied nitrogen that is easier to obtain, so the sensor can measuring to the domain of the cerebral magnetic field, by which its range of applications has been expanded to the sectors of biomagnetism measurement, non-destructive inspections and global environment measurements.

* ***Kyushu University***
Dept. of Electronic Device Engineering,ISEE
Hakozaki, Fukuoka City, Fukuoka Pref. 812
Tel: +81-92-642-3954
Fax: +81-92-641-5866



Direct coupling of the SQUID magnetic sensor
[Co-research with PTB(Physikalische Technische Bundesanstalt), Berlin, Germany

Electronics & Optics

97-11-002-01

Technology for Producing Extrabright, High-Efficiency Electroluminescence Devices

IMES Co., Ltd. has established a technology to produce extrabright, high-performance organic electroluminescence devices which are usable in place of emitting diodes (LEDs) for computer liquid crystal displays (LCD). Highly reactive metals such as lithium and strontium are incorporated in the organic molecules at the cathode interface by which the electron-injection characteristic is improved considerably.

The new technology was co-developed with Assoc. Prof. J. Kido and his research team of the Postgraduate School of Engineering, Yamagata University. Attention was directed on the fact that electron injection from the cathode undergoes an organic molecule reduction at the cathode interface (cathode boundary), so metals of excellent reducing property , such as lithium and strontium, were doped in the organic layer at the cathode interface.

Whereas electron injection from the cathode is difficult due to the high energy barrier with conventional types of devices and requires a high drive voltage, the new technology minimizes the barrier height for electron injection from the cathode, which decreases the device drive voltage substantially. Compared with conventional types of electrodes made of magnesium or lithium alloys, low-voltage drive at less than 10 V is possible, which doubles the device efficiencies, and a brightness of over 30,000cd/m^2 from Alq^f has aleady been attained. Upon the commercialization of the high-

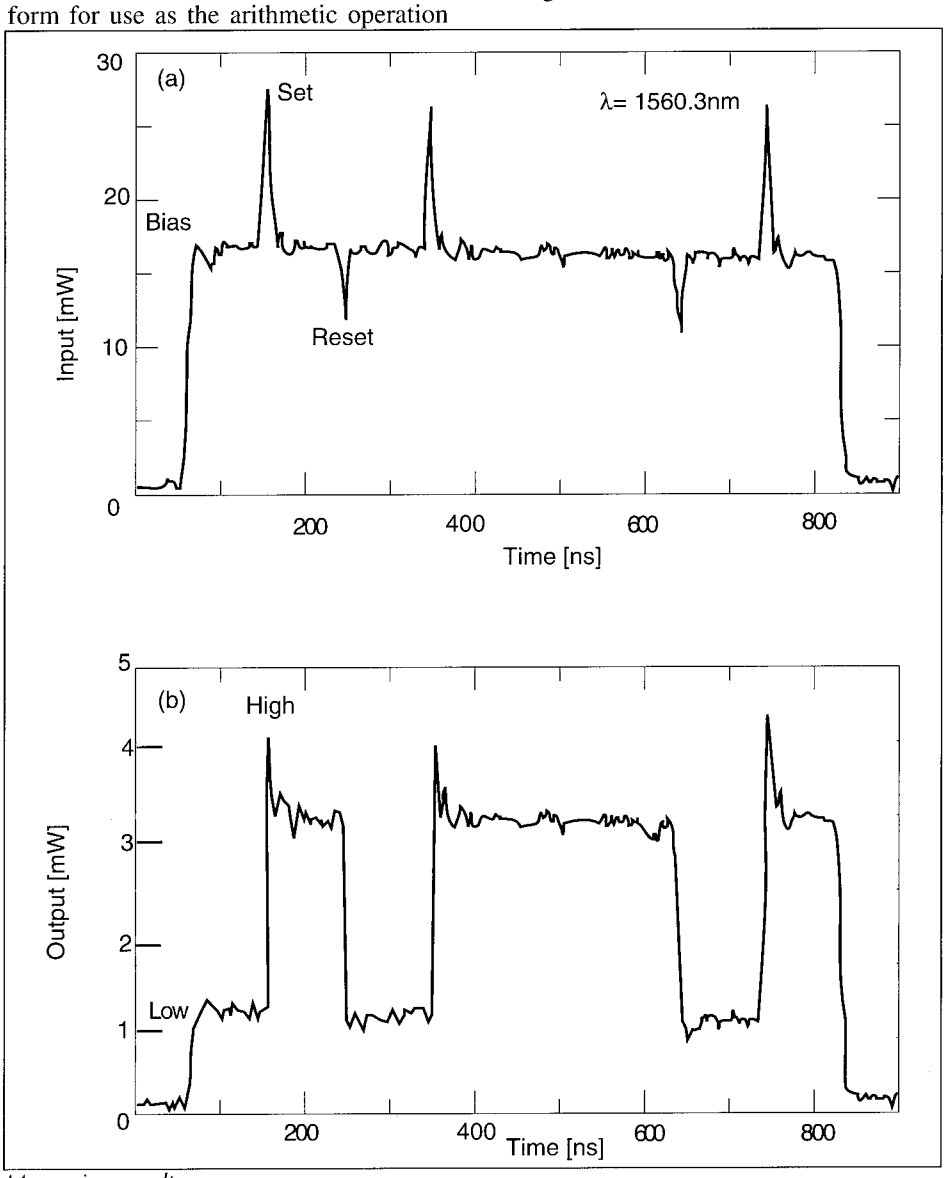
brightness EL device, the cost of the liquid crystal display is expected to be reduced to about one-half compared with TFT-LCD.

* *IMES Co., Ltd.*
3, Kirihara-cho, Fujisawa City, Kanagawa Pref. 252
Tel: +81-466-45-5922
Fax: +81-466-45-6060

97-11-002-02
First Optical Devices Produced in Chip Form with Semiconductor Manufacturing Process

Assoc. Prof. T. Mizumoto and his research team of the Department of Physical Electronics, Faculty of Engineering, Tokyo Institute of Technology, have succeeded in producing optical devices in chip form for use as the arithmetic operation and memory devices of optical computers. The chip form device can be switched ON and OFF by optical signal input, and its use enables optical signals to be changed. Similar optical devices had been available, but this is the first time that the optical device has been produced in chip form by the semiconductor manufacturing process.

The device developed by the research team is stabilized at a high output level when strong optical pulses are passed through it, and conversely stabilized at a low output level when the pulses are momentarily weakened. Using this device enables switches, memories and arithemtic circuits to be fabricated which can be controlled simply with optical signals.



Measuring result

With this device, a grating with notches equivalent to one-half of the light beam wavelength is provided in the waveguide that transmits the light beam. Normally, optical energy storage called resonance occurs inside the device, so the output light becomes smaller with respect to the input (OFF state). When the light intensity is changed and exceeds a certain intensity level, the refractive index of the device materials (gallium-indium-arsenide-phosphorus) is changed, resonance prevented, and the output becomes larger (ON state). The critical value differs when the input light is raised or lowered, so ON/OFF switching can be accomplished with ease by the method of combining the pulsating light with a standing wave having a value lying between both critical values.

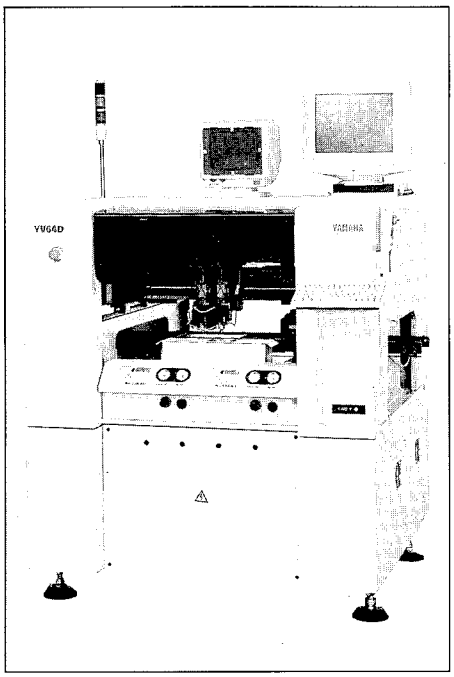
The prototype device had an output that is only one-tenth the input or involves a big loss at present, and the physical speed of changing the refractive index is also slow, so the element lacks the performance enabling use in place of existing electronic devices. The research team plans to use materials of faster response and with less optical signal deterioration, and to improve the grating to commercialize an optical device operating at a higher speed than electronic devices.

* ***Tokyo Institute of Technology***
Dept. of Physical Electronics
2-12-1, Ookayama, Meguro-ku, Tokyo 152
Tel: +81-3-5734-2578
Fax: +81-3-5734-2578

97-11-002-03
Low-Cost Dispenser for Surface Mounting Lines

Yamaha Motor Co., Ltd. has developed a dispenser that is necessary for medium-speed versatile type surface mounter lines and which is available at a low price despite its high level of coating accuracy.

The coating head is a new type of advanced pneumatically controlled head that enables a single point to be coated as quickly as in 0.13 s, and the coating accuracy is secured with stability by the introduction of a high-rigidity unit type chassis integrated in the same castings as the host machine. The cost has been suppressed substantially through the common use of parts used by existing counterparts. The



Low-cost dispenser for surface mounting lines

price of the dispenser for use in medium-speed versatile type mounter lines has been reduced to below ¥8,000,000 for the first time.

The vibrations caused by sudden axle deceleration have been suppressed through the introduction of a high-rigidity cast frame of unit construction, and a high repetitive positioning accuracy of ± 0.01mm has been secured through high-speed, high-accuracy axle control based on a proprietary high-speed servosystem. The fuzzy control technique is introduced to control the liquid temperature inside the adhesive syringe to permit safe coating. The dispenser compatible with the company's full vision surface mounter that mounts all parts by visual recognition, and since the mounter and controller are common, a common manipulation system is usable that simplifies the dispenser operation. In addition, the mounter can prepare the dispensing (coating) data automatically from data relating to the mounted parts.

The use of a total-axes AC servo motor eliminates the need for replacing the motor brushes, making the system maintenance-free. A coating volume detection and automatic coating volume adjustment system based on visual recognition using a CCD camera is available optionally, by which any abnormality in the coating volume can be detected and the coating volume adjusted automatically during the dispenser operation.

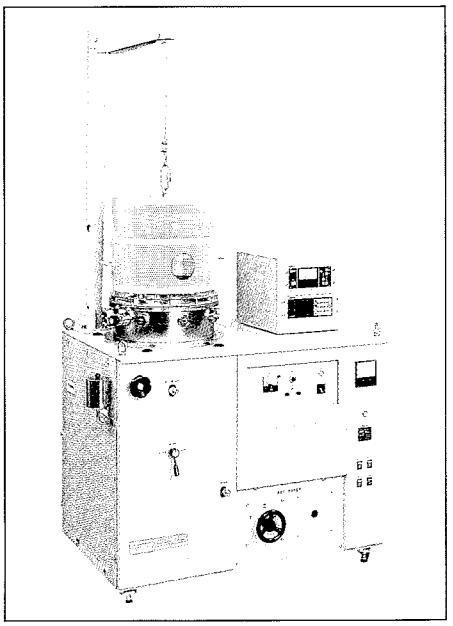
* ***Yamaha Motor Co., Ltd.***
Public Relations Dept.
2500, Shingai, Iwata City, Shizuoka Pref. 438
Tel: +81-538-32-1145
Fax: +81-538-37-4250

97-11-002-04

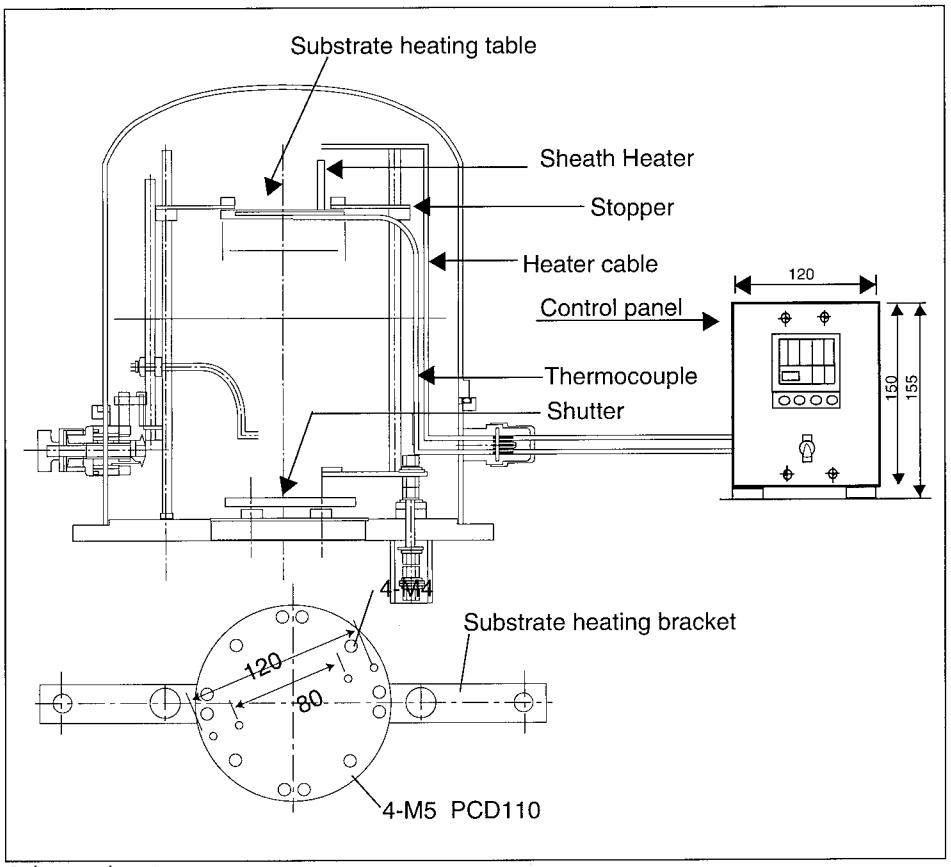
High-Speed Exhaustion Type Vacuum Vapor Deposition System

Sinku Kiko Co., Ltd. has developed a high-speed exhaustion type vacuum vapor deposition system VPC-1100. The vacuum tank inside diameter has been increased from the usual diameter of less than 300 mm to 390 mm to enable both experimental fabrication and the actual manufacture of mass production products. The vacuum pump and other ancillary equipment are integrated compactly to enable the system to be moved about with ease.

The vacuum pumping speed has been enlarged to shorten the riseup time (the period of time from system switching to the attainment of the usable state) to 10 min (usually about one hour). The time from completion of system operation to system switch-off has also been shortened to 15 min (usually about one hour), so high-speed exhaustion has been realized.



Vacuum vapor deposition system VPC-1100



Substrate heating system

The system is marketed at a standard domestic price of ¥3,300,000.

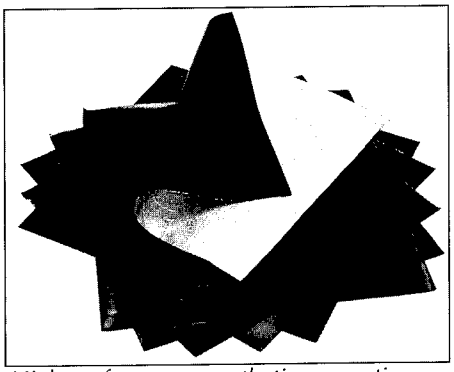
* ***SINKU KIKO Co., Ltd***
2-7-19, Shinyokohama, Kouhoku-ku,
Yokohama City, Kanagawa Pref. 222
Tel: +81-45-474-2011
Fax: +81-45-474-2010

97-11-002-05
High-Performance Synthetic Magnetic Wave Absorption Film

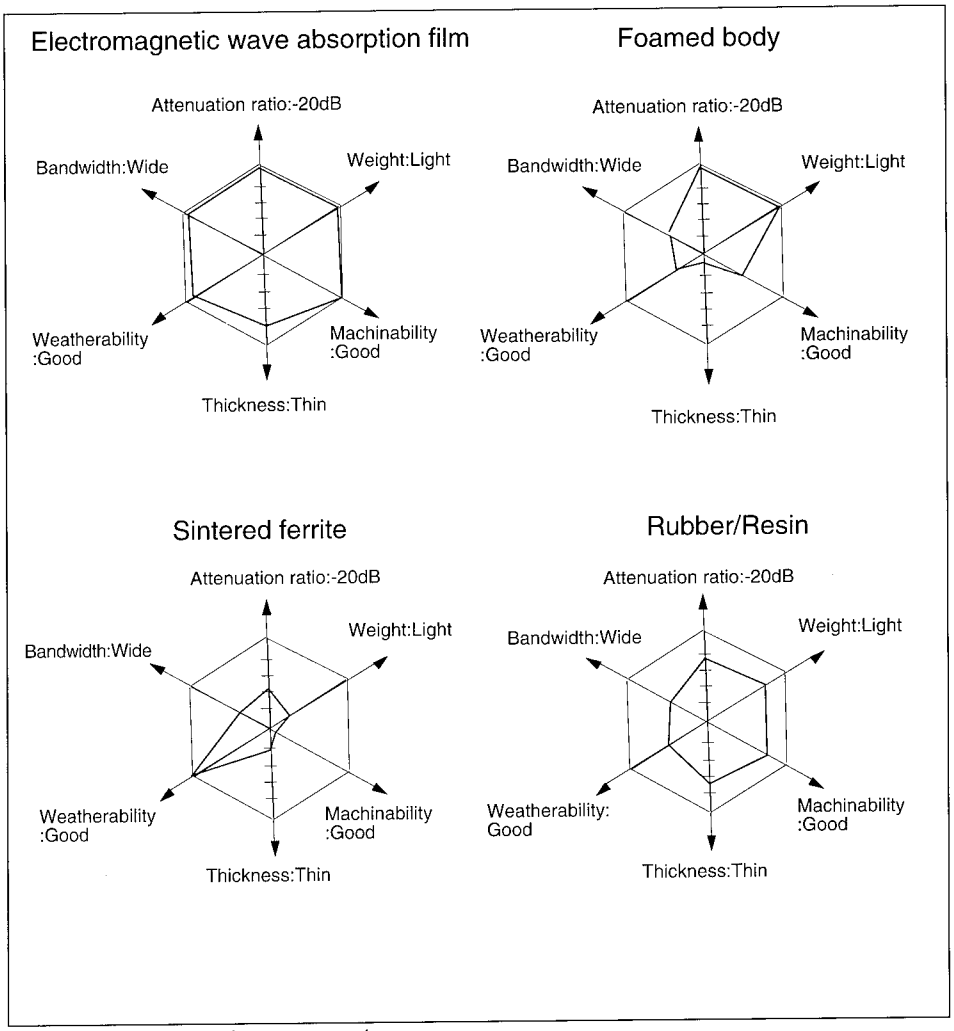
Nihon Enesys Co., Ltd. and Kansai Paint Co., Ltd. have jointly developed a thin laminated synthetic film that absorbs electromagnetic waves generated by electronic equipment most efficiently.

The thin film consists of about a dozen layers of thin film-form ferromagnetic and ferroelectric materials. The dielectric loss effect caused by the laminated construction and the energy loss effect caused by reflection absorb the electromagnetic waves which are a cause of equipment malfunctioning. The film has a wide absorption domain, the incidence property is excellent and it can be machined with ease due to its great softness.

The domestic selling price is about ¥100,000/m², and the company plans to lower this price to about ¥80,000 within two years. The electromagnetic wave absorption domain can be set freely, and with electromagnetic waves peaking at about 9 GHz, the film thickness is 2-3 mm.



High-performance synthetic magnetic wave absorption film



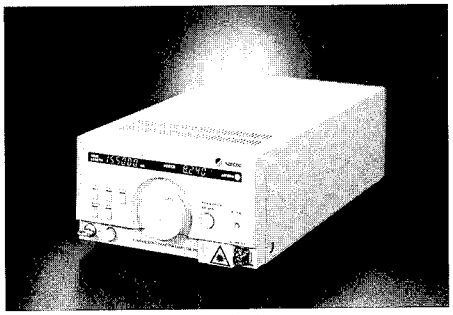
Film image by type of magnetic substance

* ***Nihon Enesys Co. Ltd.***
5-17-11, Ogikubo, Suginami-ku, Tokyo 167
Tel: +81-3-3220-0900
Fax: +81-3-3220-0903

97-11-002-06
Compact Tunable LD Light Source, TSL-210

Santec Corp. has developed new mini tunable laser source, TSL-210.

Performance of TSL-210 is dramatically improved using a newly developed external cavity and LD design. A high optical output of over 10mW and wide tuning range of over 80nm are achieved. Furthermore, 1/1000 excellent continuous wavelength tuning can be done with the fine tune tuning mode using new functions. A newly designed front panel can help easy operation. APC, coherence control function, GP-IB/RS232C interface and wavelength calibration are equipped as well.



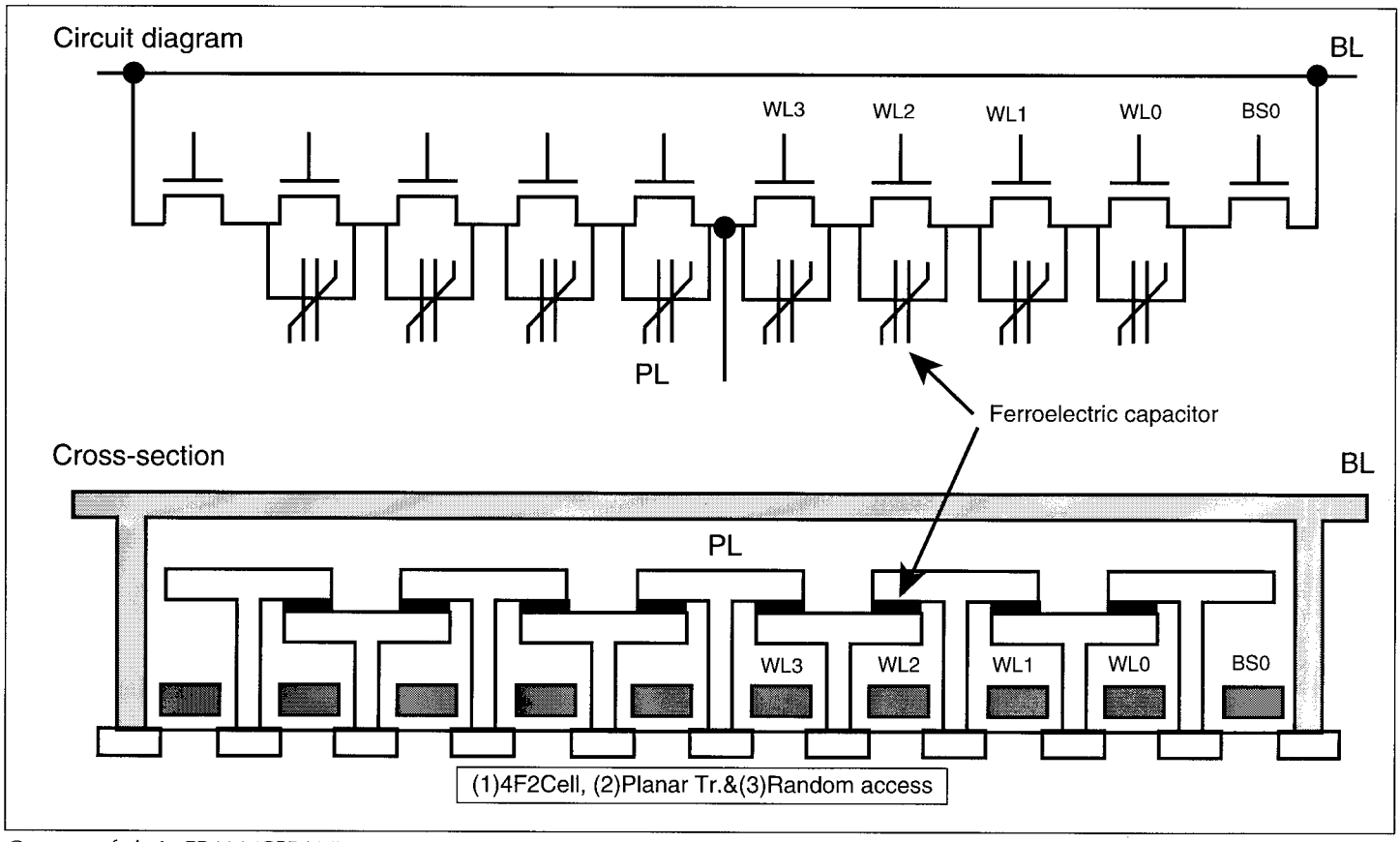
Compact tunable LD light source, TSL-210

TSL-210 can be used in a variety of applications in research labs as well as production and field environments of fiber optics communications.

* ***Santec Corporation***
Micom Valley Tohkadai, Kamisue,
Komaki City, Aichi Pref. 485
Tel: +81-568-79-3535
Fax: +81-568-79-3538

97-11-002-07
Compact High-Speed, High-Density Chain FRAM

Toshiba Corp. has developed a new ferroelectric random access memory (FRAM) circuit with a cell area 50% smaller and cycle time over three times faster compared with those of conventional counter-



Concept of chain FRAM (CFRAM)

parts. The ferroelectric capacitor was previously connected in series with the element (transistor), but in the new cell the capacitor is connected in parallel to form a block structure in which the components including the bit selection element are connected in series. This reduces the chip area to 63%, reducing the manufacturing cost, and achieves a high speed comparable to that of the dynamic random access memory (DRAM) despite being a volatile type. Since this new cell has a structure resembling a chain, the company calls this new circuit the CFRAM.

The FRAM cell area is limited theoretically to 8 times the square of the minimal dimensions, but the new circuit makes a breakthrough in this concept and reduces the area to one-half, or to 4 times the square of the minimal dimensions. In addition, since connection is achieved in bit line in block units, the bit line capacitance burden is reduced compared with series connection of the respective cells in the conventional bit line format, so that the area of the sensing circuit is reduced to one-fourth. The cumulative effect is to reduce the chip overall area by about 40%.

Conventional types of FRAM are driven by changing the plate voltage so the cycle time is 250 ns, or rather slow, but with CFRAM, the plate voltage is fixed and a speed of 70 ns is attained without refreshing action, or a high-speed cycle time comparable to that of the DRAM is realized. With CFRAM, data can be retained without refreshing simply by switching off the bit line selection element during waiting. Readout is achieved by switching on the bit line selection element, and random access possible by switching off the cell concerned.. The company plans to apply the new technology and to develop next-generation version FRAMs.

* ***Toshiba Corporation***
Corporate Communication Office
1-1-1, Shibaura, Minato-ku, Tokyo, 105-01
Tel: +81-3-3457-2105
Fax: +81-3-3456-4776

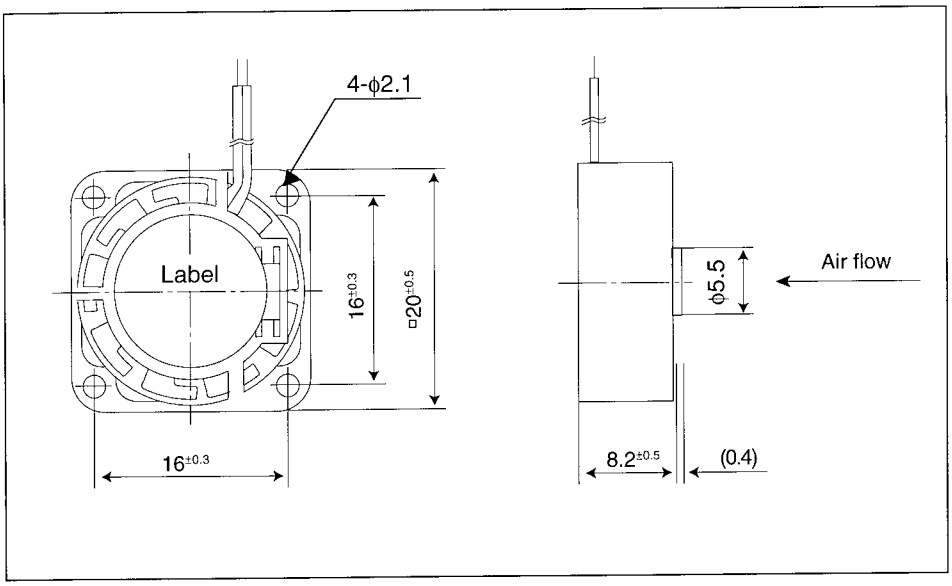
97-11-002-08

Ultracompact High-Performance Fan Motor

Shicoh Engineering Co., Ltd. has started marketing an ultracompact and lightweight fan motor available as Model 2008 that measures 20 × 20 mm and weighs only 5.3g.

It anticipates to sell 100,000 units of the fan motor in the initial fiscal year. As a recent trend, with notebook type personal computers, for example, cooling is being performed by pinpoint cooling with small fans rather than overall cooling with large fans. The new ultracompact fan motor is designed to meet the needs of this trend, and expected to expand the degree of freedom of designing substantially. Also, its use as a fan inside automobile cabins is also increasing.

Up till now, the company's 25 × 25 mm product was the smallest, but further miniaturization was achieved by improving the fan shape and core winding method. The fan is made of metal of minimal thermal deformation, and its heat resistance has



been improved (working temperature of up to about 60°C). Also, since the linear electric conductance method is adopted, the motor operates silently and with minimal magnetic wave leakage. The fan motor is marketed at a domestic price of ¥1,000/set.

* ***Shicoh Engineering Co., Ltd.***
1542, Shimotsuruma, Yamato City, Kanagawa Pref. 242
Tel: +81-462-75-3310
Fax: +81-462-76-7995

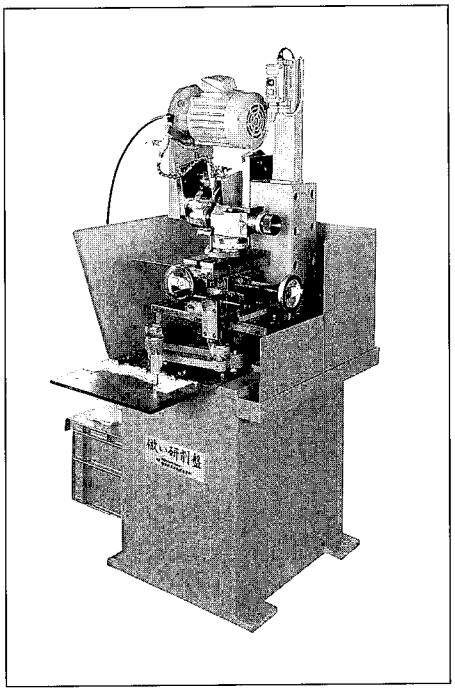
Machinery & Mechatronics

97-11-003-01
Compact Contouring Grinder

Tatsumiya Company has started marketing a compact, space-saving contouring grinder PGC-97. This is a vertical contouring grinder that performs contouring by using a template that is 5 times larger than the target workpiece to be machined. The compactly designed contouring grinder has been developed successfully by suppressing the maximum machining width to 70 mm and by designing a compact pantograph for plate contouring.

This grinder performs cemented carbide and high-speed steel blade-forming operations for producing formed cutters, formed rooter bits, forming tools and formed cutters for use in woodworking and metalworking by employing a template with a size 5 times larger than the target workpieces, and the contouring work can be accomplished quickly and with ease even by an unskilled worker.

The grinder is installed in a space with a width of 700 mm and depth of 900 mm, about one-half those required by ordinary contouring grinders. The company observes that the new contouring grinder is ideal for the needs of small- and medium-scale woodworking and metalworking enterprises. The new grinder is marketed at a low domestic price of ¥2 million.



Space-saving contouring grinder PGC-97

* ***Tatsumiya Company***
766-2, Nakano-machi, Hamamatsu City, Shizuoka Pref. 435
Tel: +81-53-422-0675
Fax: +81-53-422-4701

97-11-003-02
Aluminum Welding Software For Robot

Mitsubishi Materials Corp. has developed technology to weld large-sized aluminum parts by the use of an automated aluminum welding robot. This software is using with a welding robot system developed jointly by NTT Corp. (Nippon Telegraph and Telephon Corp.) and other companies, and introduces expertise relating to aluminum welding possessed by skilled welders. Aluminum welding involves large expansion and deformation due to the generated heat, so this task previously relied on skilled welders. The development of the new automated aluminum welding technology using a robot is anticipated to stabilize the quality levels of aluminum weldings and to reduce costs substantially.

The aluminum welding robot developed jointly by NTT Corp., NTT Fanet System Corp. and Daihen Co., Ltd., mounts a laser-vision sensor for welding and software incorporates expertise relating to aluminum welding. The system was installed and is being operated in a tank welding line for cement transport trucks (bulk cement trucks) at the Mitsubishi Materials Co. Shizuoka Works in Shizuoka Prefecture.

The welding line welds four aluminum plates comprising both semicircular terminals of a semicircular cement tank. Up till now, these plates was welded manually since the welding lines are curved, but now the new robotized welding system performs this welding task while detecting thermal deformations with a sensor and correcting the welding lines.

* ***Mitsubishi Materials Corporation***
Aluminum Fabricated Products Dept.
Aluminum Div.
Shinmaru Bldg. 1-5-1, Marunouchi, Chiyoda-ku, Tokyo 100
Tel: +81-3-5252-5393
Fax: +81-3-5252-5438

Information & Communications

97-11-004-01
First 25-Inch XGA Image Quality Color Plasma Display Panel

Hitachi, Ltd. has announced it will start shipping samples from December this year a 25-inch color plasma display CMP250X-J, HIPLASMA featuring a high-definition image XGA display (1,024 x 768 dots).

A high-definition construction is introduced that enables a pixel pitch of 0.165 mm horizontally and 0.495 mm vertically, by which the XGA picture quality has been realized for the first time, and a high contrast of 1/200 has been achieved by a unique drive system that enables reduction of preliminary discharge that is characteristic of the plasma display panel. The basic performance is represented by an angle of vision of 160 degrees and brightness of 100 candela, and the integrated system incorporating the power unit features a thin and lightweight configuration with a depth of 11 cm and weight of 19 kg.

The panel features a function of simultaneously displaying icons on the screen and mounts a multiscan circuit that automatically discriminates and regenerates personal computer signals and video signals of various picture qualities as its standard specifications, and can respond to various types of commercial applications. The color plasma display panel is distributed at a domestic sampling price of ¥2,500,000.

* ***Hitachi, Ltd.***
Public Relations Secretary's Office
6, Kanda-Surugadai, 4-chome, Chiyoda-ku, Tokyo 101
Tel: +81-3-3258-1111
Fax: +81-3-3258-5480

97-11-004-02
New Fujinon Ultrawide-Angle News Gathering (ENG) TV Lens

Fuji Photo Optical Co. Ltd. has developed a new ultrawide-angle TV zoom lens Wide Power Jr. A12 × 6.8. This new ENG lens has many new features.

Up till now, it has been quite difficult to use a single TV zoom lens to shoot a wide range of images from wide-angle to telescopic images. The new A12 × 6.8 lens features the widest field of view from 65° (in horizontal for 4:3 format) to 6° available for this class of lenses. Close-up shooting is very important in interviews of persons. Dynamic realistic pictures can be taken closer to the object. The new ENG lens features a minimum object distance of 0.5 meters, and can create dynamic appealing images by striking a good balance between the close object and the background.

Wide power Jr. A12 × 6.8

Ease of use and improved mobility has been achieved by use of an inner focus mechanism, and user-friendly designs are adopted in all parts of the lens from the main body to the grip. In addition, the total weight has been reduced to 1.38kg for the realization of the compact, light weight ENG lens that is easy to use and carry. Equipped with an aluminum die cast grip and a square hood, the lens is durable and reliable for professional use.

High resolution images comparable to those of standard broadcasting TV lenses are provided by the computer-designed, superlative optical system. Longitudinal chromatic aberration, lateral chromatic aberration and coma aberration are decreased considerably to maintain high performance for high quality imaging.

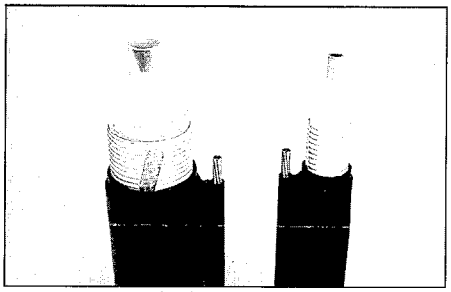
The New Fujinon Wide Power ENG lens is marketed in Japan at a price of ¥470,000.

* ***Fuji Photo Optical Co., Ltd.***
1-324, Uetake, Omiya City, Saitama Pref. 330
Tel: +81-48-668-2101
Fax: +81-48-668-5265

97-11-004-03
Heat-Resistant Leakage Coaxial Cable

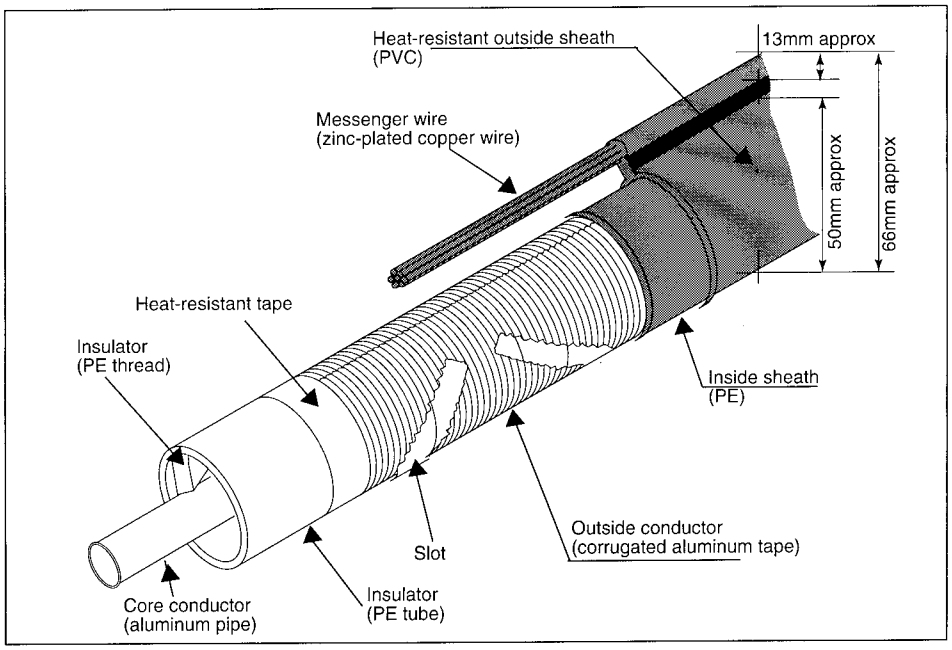
Heat-resistant leakage coaxial cables are used as auxiliary radio communications facilities in the underground floors of buildings and inside road tunnels. These cables are required to conform to Article 31, Clause 2-2 of the Enforcement Regulations, Fire Services Act, to enable rapid liaison with the outside world in case of an emergency such as fire, and are therefore required to have a fireproof construction.

Up till now, the heat-resistant leakage coaxial cables used in public facilities had to be reported to the supervising local fire bureau and became usable only after acquiring a permit. To simplify these operations, the act was revised to permit the Fire- and Heat-Resistant Cable Approval Committee established in the Japan Cable Industrial Association to provide approval, and responsibility was transferred from the Fire Defence Agency, Ministry of Home Affairs, to the Japan Cable Industrial Association in March 1997.



Heat-resistant leakage coaxial cable

Hitachi Cable, Ltd. has acquired approval for its 29-mm and 51-mm heat-resistant leakage coaxial cables for common use in the 150 MHz and 400 MHz bands. The accompanying diagram shows the typical construction of these heat-resistant leakage coaxial cables. The heat resistances of these cables are shown in the ac-



Typical construction of heat-resistant leakage coaxial cable

companying table when heated for 30 min at one-half of the fire curve (fire heat curve that attains 840 °C in 30 min). These cables are used for radio communications supplementary facilities in the underground floors of buildings, and inside automobile tunnels.

* ***Hitachi Cable, Ltd.***
Engineering & Development Group
2-1-2, Marunouchi, Chiyoda-ku, Tokyo 100
Tel: +81-3-5252-3295
Fax: +81-3-3201-0508

97-11-004-04
World's First Single Unit 200-Inch Rear Projection Type Screen

Dai Nippon Printing Co., Ltd. has developed a rear projection type screen of 200 inches that is a lens screen type capable of regenerating clear images. It is designed for use as a large projector type video system.

Up till now, the same type of screen wider than 160 inches was formed by laterally bounded multiple screens, and this is the first time that an integrated type has been fabricated. The manufacturing cost is about one-half that of the company's existing conventional products.

The new type of lens screen will be manufactured by the company's Denmark subsidiary. A circular Fresnel lens with vertical stripes (Lenticular lens) is formed with a 200-inch die. There is no need for lamination or joining, so quality improvement and costdown are achieved simultaneously. As a result, the 200-inch rear projection type screen is now available at about one-half the price.

* ***Dai Nippon Printing Co., Ltd.***
Press and Public Relations
1-1-1, Ichigaya Kaga-cho, Shinjuku-ku,
Tokyo 162-01
Tel: +81-3266-2102
Fax: +81-3266-2129

97-11-004-05
High-Performance 15-Inch Supertorsional Nematic Liquid Crystal Monitor

Sharp Corp. has started marketing a 15-inch supertorsional nematic (STN) liquid crystal monitor featuring extra-clear images. The shadowing phenomenon of shadows generated along the fringes of characters and other images has been suppressed considerably, and the contrast has been doubled compared with those of its conventional counterparts. It is designed mainly for use as an office personal computer monitor.

The new product is a 15-in XGA monitor (number of pixels: 1,024 x 768) whose size is equivalent to a 17-inch monitor of CRT screen. The use of low-viscosity liquid crystal has increased the response speed to make the monitor compatible with dynamic images. The drive system has been improved and the shadow ratio that indicates the density of shadows has been suppressed to below 5%.

The company earlier commercialized a 12.1-inch high-definition STN liquid crystal for notebook type personal computers, but developed the 15-in version this time due to the big demand for monitors with larger screens.

* ***Sharp Corporation.***
Corporate Public Relations Div.-Tokyo
8, Hachiman-cho, Ichigaya, Shinjuku-ku,
Tokyo 162
Tel: +81-3-5261-7271
Fax: +81-3-3260-1822

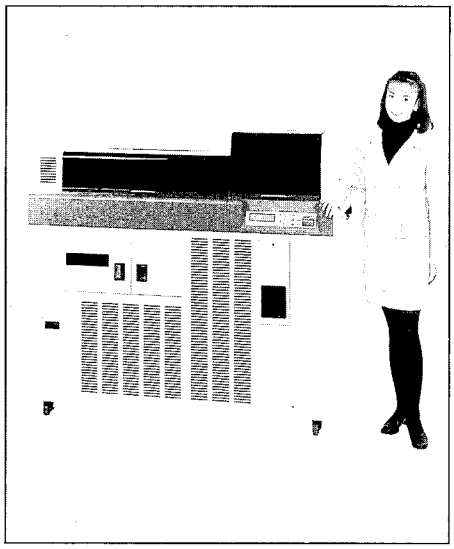
97-11-004-06
High-Security Photo ID System and IC Card Issuing System

Konica Corp. has been developing an IC card that has no electrical contact point on its outside surface, or the contactless type IC card that is highly resistant to counterfeiting and destruction compared with other types of IC cards, and has succeeded in establishing a technology to form high-fidelity facial images on the IC card front face and an ID card printer to simultaneously print images and store information in the IC card.

The facial image is recorded inside the IC card, so counterfeiting or tampering with the card is quite difficult. The facial image printed on the face of the IC card and data relating to the same image are stored in the IC card by data compression treatment, so even if the photo on the face of the IC card is replaced, the fraud can be discovered with ease using the data stored inside the IC card. Further, the data inside the IC card as well as the communications between the IC card and the reader/writer are encryoted, so information decoding from the outside will be quite difficult.

A single IC card has many uses. The domain inside the IC card can be divided into several sub-domains and each subdivided domain put to some exclusive use. The card has a durability conforming to ISO 7810 and is usable for over 5 years even under harsh conditions. It can withstand heat of over 80 °C, and resists ultraviolet rays. The IC card is made primarily of PET, so does not generate any ozone layer destroying substance when disposed of or incinerated.

The Konica IC Card Issuing System is used in combination with an On-Line Camera and a Photo-Scanner in an issuance office linked to a host computer, as well as in combination with an Off-Line Camera in a regional issuance office not linked to the host computer.



ID card printer

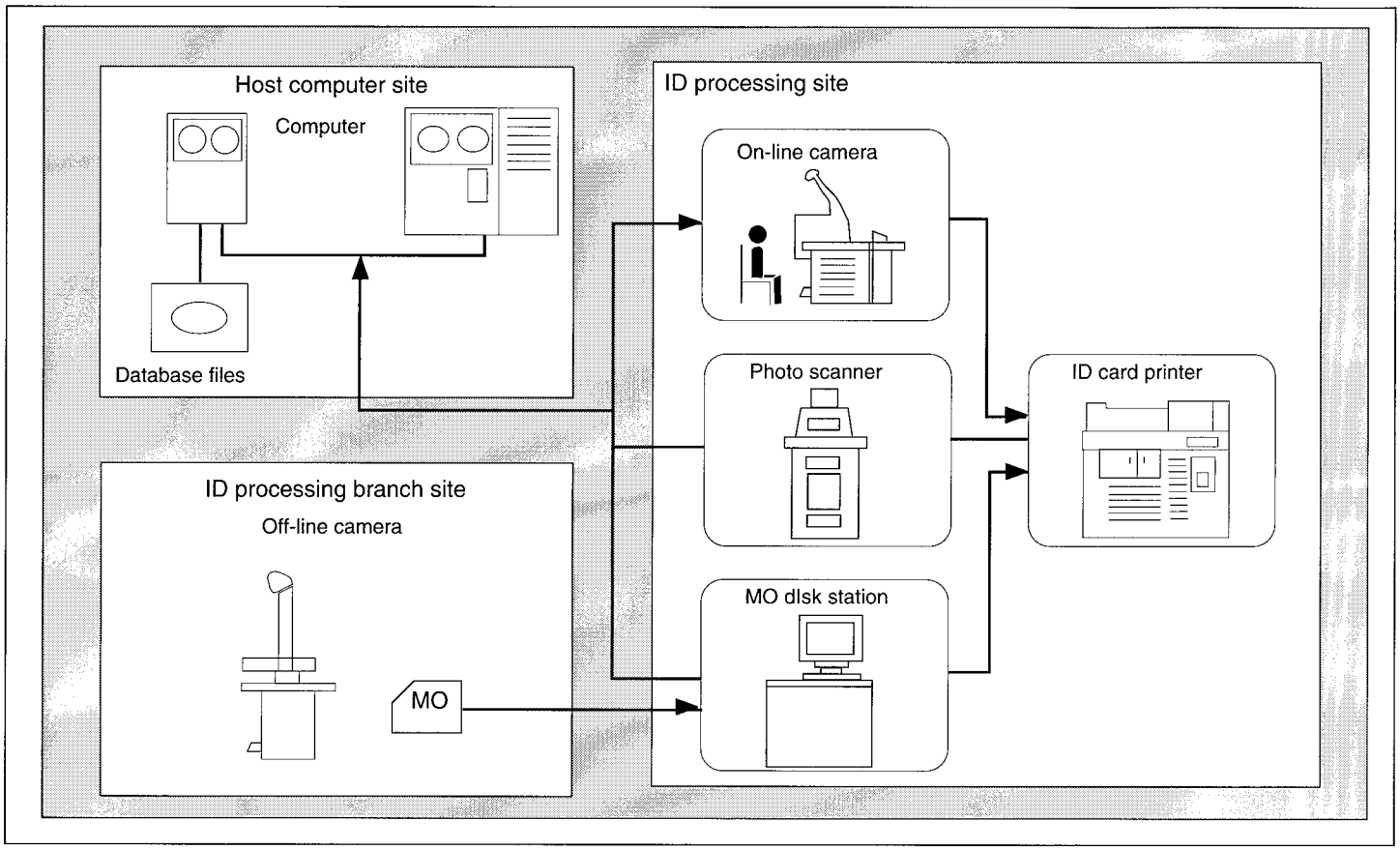
The On-Line Camera transfers the applicant's digital facial image data photographed directly with a video camera to the ID card printer, as well as the personal data trasmitted from the host computer. The ID card printer prints the facial image and personal data on the face of the IC card, and simultaneously stores the personal data and the compressed facial image data printed on the card into the IC card

The Photo-Scanner transfers the digital facial image data obtained by taking a picture of the applicant's photograph pasted on the application form with a video camera to the ID card printer as well as the personal data transmitted from the host computer. The ID card printer prints the facial image and personal data on the face of the IC card, and simultaneously stores into the IC card the personal date and the compressed facial image data printed on the card. These two systems are linked directly to the host computer, so ID card issuance is possible on the day of application.

The Off-Line Camera is located at an issuance office not linked on-line with the host computer, so records the digital facial image data of the applicant photographed directly with a video camera on a magneto-optical disk. The magneto-optical disk is mailed to an issuance office equipped with a regeneration system (MO Station). The facial image data stored in the magneto-optical disk is read out at the MO Station linked on-line with the host computer, then transferred to the ID card printer together with the personal data transmited from the host computer. The ID card printer prints the facial image as well as the personal data on the face of the IC Card, and simultaneously stores the personal data and the compressed facial image data printed on the card into the IC card.

The Konica IC Card Issuing System can provide various types of systems which respond flexibly to all kinds of ID card issuance requirements.

* ***Konica Corporation***
R&D Center
1, Sakura-cho, Hino City, Tokyo 191
Tel: +81-42-589-8468
Fax: +81-42-589-8078



Process & Production Engineering

97-11-005-01
All Electric Injection Molding Machine with Mold Clamping Force of 350 tons

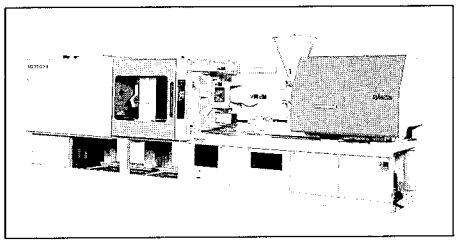
Niigata Engineering Co., Ltd., has developed an all electric injection molding machine MD350S-III that is driven with servo motors and which has a mold clamping force of 350t. Two servo motors are mounted at the injection part for the first time, achieving the highest capacity for an all electric type molding machine.

MD350S-III adopts the stable twin motor drive system and applies a unique servo motor control technique, which has been established for the first time in injection molding (patents pending). This enables the servo motor to cope with large capacity machines, suppresses the total inertia and permits high response. Also, newly developed controllers specifically designed for servo motors have considerably improved control performance. A clear color LCD with a wide angle visual field is incorporated, and the high resolution touch panel provides user-friendly operation.

The servo motor drive guarantees molding with high repeatability tracing the setting of each movement exactly and providing stable products. The products deviation is less than one-half that of hydraulic machines. Since there is no variation between machines, the electric machine can mold products consistently even with different machines.

Servo motors, which only consume energy when required, save considerable energy compared with the hydraulic system. Consumption of cooling water, used only for the feed throat, is also significantly reduced. Of course, hydraulic oil is not required at all.

The constant pressure filling system (CPF) reduces peak pressure at the completion of injection, decreases the injection speed automatically, and transits to the holding stage smoothly. Due to these features, molded products should have smaller built-in stress and deformation,



All electric injection molding machine MD350S-III

and flashing or burning is avoided. Molding conditions can be set easily, so no sophisticated expertise needed. In addition, since the machine is controlled by an independent servo motor for each axis, it enables simultaneous motion for shorter cycles. Accurate positioning control realizes high-speed mold opening, which makes the machine ideal for running with automation.

The plasticizing capacity is 122 to 165kg/h, the shot mass is 415 to 550g, and the mold clamping system is double toggle. The price of MD350S-III with standard specifications is ¥ 24,700,000 in the Japanese domestic market.

* ***Niigata Engineering Co., Ltd.***
Public Relations Dept.
1-10-1, Kamatahoncho, Ohta-ku, Tokyo 144
Tel: +81-3-5710-7722
Fax: +81-3-5710-4751

97-11-005-02
Low-Cost Pure Water Recycling System

Liquid Concerned Co., Ltd. and Osaka Municipal Industrial Research Institute have jointly developed a pure water recycling system that can produce extra-pure water at a cost that is less than one-half that of conventional counterpart systems. Duplex filtration is performed with a filter using a special type of unique adsorbent, and the recycling of pure water regenerated from waste semiconductor and electronic components washing water has been realized for the first time. An ion exchange resin is used for producing extra-pure water.

Normally, when recycling pure water, the original waste water is coagulated and precipitated, followed by processing with an activated carbon adsorbent to produce raw pure water for producing pure water (primary system raw water). However, this conventional method is disadvantageous in that it involves working with waste water that may be difficult to coagulate and precipitate, requires separate treatment of the coagulated and precipitated substances, and demands the regeneration of the activated carbon that has been saturated by adsorption.

The newly developed system uses a coagulation and filtration system that filters the waste water with an SA filter in the first stage. The ultrafine particles coagulated by the filtration unit are collected into a large floc, so ultrafine particles which are normally difficult to coagulate, depending on the type of waste water, are coagulated most efficiently to display an extremely high filtration efficiency, so that the load on the subsequent membrane filtration process is alleviated substantially.

A special type of magnesium-based adsorbent was developed to enable the removal of ultrafine particles of 0.1 μm without any clogging, so that other impurities can be removed effectively by low-pressure inverse osmotic membrane in the subsequent process. In addition, the treated water is usable as a water for supply to a secondary treatment system for further improving the purity of the water.

* ***Liquid Concerned Co., Ltd.***
Public Relations Dept.
2-11-18, Houshin, Higashi-yodogawa-ku, Osaka City Osaka 533
Tel: +81-6-327-6911
Fax: +81-6-327-0459

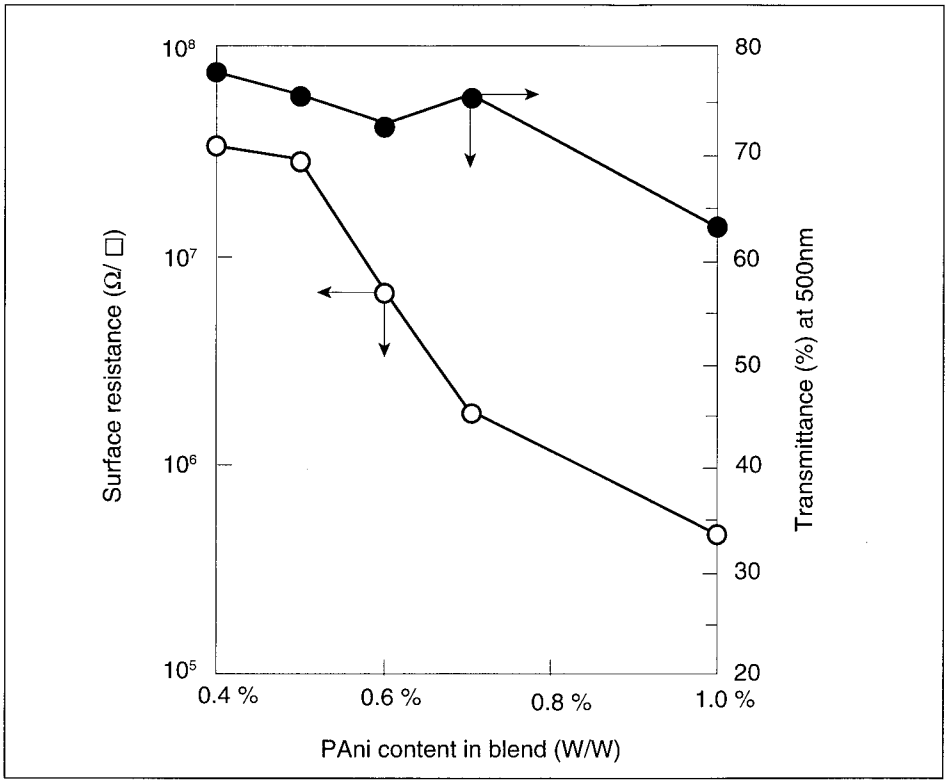
97-11-005-03
Ultrasonic Washing System for Automotive Parts

S&C Co., Ltd. has developed a new type of ultrasonic washing system Giga Wave 6 that combines a number of present technologies. The new ultrasonic washing system consists of a washing process using ultrasonic waves, three rinsing processes and two drying processes, and incorporates the functions of using a round cage and square cage in combination, washing targets made of iron and other metals, drying by the company's patented suction drying process and recycling the waste water.

Giga Wave 6 provides powerful ultrasonic wave washing, shower washing with hot water and automatic air blow drying. Cavitation control is performed accurately to enable the removal of ultraminiscule foreign substances, and an ultrasonic oscillator based on simultaneous 10-wave oscillation (25-300 kHz) improves the washing efficiency considerably. In particular, the drying process that is a problem when water-washing is replaced by suction drying in which residual water is removed exhaustively from voids. A rust inhibitor is added to prevent corrosion in the rinse process.

The 6-process type is for washing automotive parts. Depending on the target parts, a system is available optionally to perform washing in 4 or 5 processes. The system is marketed at a domestic price of ¥40-50 million, depending on its specifications.

* ***S&C Co., Ltd.***
Public Relations Dept.
1-1-32, Shinurashima, Kanagawa-ku,
Yokohama City, Kanagawa Pref. 221
Tel: +81-45-451-2260
Fax: +81-45-453-7410



Surface resistance and transmittance of Polyaniline (PAni) blend films with PMMA as a function of PAni wt %

97-11-005-04

Polyaniline Mixture Provides Electrical Conductivity

Assoc. Prof. N. Kuramoto of the Graduate School of Engineering, Yamagata University, has succeeded in developing a polyaniline high polymer that can be synthesized easily with a single polymerization process and which provides electrical conductivity in various types of materials simply by mixing at less than 1%. When a thin membrane was produced by adding less than 1% of polyaniline to an acrylic resin, the membrane was usable as a charge-resisting material, and when the mixture ratio was increased, it became electrically conductive and usable as a magnetic wave shielding material.

Polyaniline is an aromatic conductive high polymer that has stable electrical conductivity and can be synthesized readily at low cost, so is an excellent electrically conductive polymer for commercialization. Polyaniline electrically conductive polymer was commercialized as the cathodic material of the first plastic secondary batteries, and has also been commercialized for use as a charge prevention material, electromagnetic wave shielding material and anticorrosion paint.

The material is also expected to be used in the sectors of electrical, electronics and machinery as an electrical and electronics material for producing electrochromic elements and microsensors, and as a mechanical material for producing electrorheological fluids and artificial muscles (electro-mechanical conversion actuators). The electrically conductive polymer has already been commercialized by Zipperling Co. of Germany and is available in the world market. However, applications have been delayed due to the poor meltability, and the resin becomes separated from a mixture, so it will be necessary to improve the inter-particle contact in order to achieve electrical conductivity improving the mixing ratio. Melting may also deteriorate the conductance.

The polyaniline was synthesized by the micelle polymerization process of polymerizing aniline in the presence of surface active micelles. The polymer was a colloid in an organic solvent and became a solution of uniform transparency. Polymerization of raw material aniline was achieved with a single stage of polymerization by using surface-active anion. By utilizing this colloidal polyaniline solution, and mixing with an m-cresol solution of polymethyl methacrylate (PMMA), a type of acrylic resin, the compound membrane was formed.

A mixture of only 1% polyaniline by weight has been confirmed to provide an electrical conductivity of (10^{-3} - 10^{-5} (Siemens/cm) S/cm) with a thin membrane of 10-20 μm, so a membrane with a surface resistance of (10^5 - 10^7Ω/□) ohms/unit area is obtained. Such specific conductance and surface resistance are lower than the resistance of (10^{12}Ω/□) ohms/unit area necessary for displaying the charge prevention effect, so the material features adequate characteristics for use as a charge inhibitor. A mixture of 10-30% indicated a specific conductance of several siemens, which makes the material usable for producing electrically conductive paints, rust prevention paints and electromagnetic wave shielding agents.

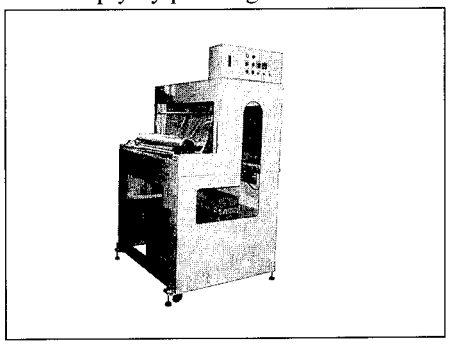
* ***Yamagata University***
Graduate School of Engineering
4-3-16, Jonan, Yonezawa City, Yamagata Pref. 992
Tel: +81-238-26-3051
Fax: +81-238-24-7241

Construction & Transportation

97-11-005-05

Machine for Packaging Long Products

Ohata Seisakusho Co., Ltd. has started marketing a newly developed Long Product Packaging Machine, Model NZ-3 that positions the folded boxes for long products horizontally and wraps them with a film simply by pressing the switch.



Long Product Packaging Machine, Model NZ-3

When using this machine, a folded box is positioned on a creased film from the side of the machine. When the switch is turned on, the film descends and wraps the wooden box, after which the upper part of the film is cut with a hot cutter at 120-130 °C and sealing performed simultaneously. The packaging work is accomplished with ease, and as many as 600 packages can be prepared in an hour by continuous operation.

The machine is usable for packaging boxes with a maximum size of (L) 80 × (W)28 × (H)28 cm. It can set folded boxes sidewise, so when working with boxes with depths of 2 cm, it is usable for packaging as many as 40 stacked boxes at once. The machine is also usable not only for working with wooden boxes but as well for packaging long Welsh onions, burdocks, yams and carrots.

The machine has a size of (L)1,250 × (W)1,312 × (H) 1,950 mm, and weighs about 200 kg. Creased films with a maximum width of 100 cm and minimum thickness of 0.03 mm can be used. The motive source is a pneumatic system of over 5.0 kg/cm and a 3-phase electric source of 200 V. The domestic price is ¥1,200,000

* ***Ohata Seisakusho Co., Ltd.***
Public Relations Dept.
2455-2, Kuragano-cho, Takasaki City,
Gunma Pref. 370-12
Tel: +81-273-47-2395
Fax: +81-273-47-3420

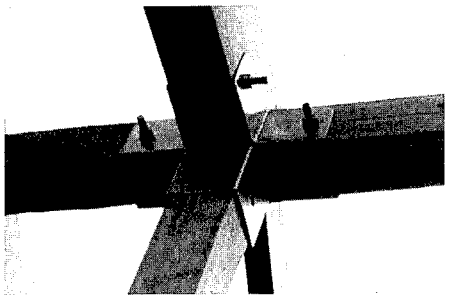
97-11-006-01

New Type of Metal Fixture for Joining Housing Unit Pillars and Beams

Kanechu Co., Ltd. has developed a new type of metal fixture called King Joint for joining the pillars and beams of housing units. Bolts are used for fixation, so the fixture features excellent safety and stability.

King Joint has a basic shape in which hollow tubular arms extend in several directions. The hollow tubular arms serve to accommodate the terminals of various types of framework members, and the terminal parts of these framework members and the arms are designed to form firm joints together with the bolts provided outside the arm. Depending on the design, 1-3 arm parts are welded at right angles. Firstly, the pillar is inserted into the tubular fixture, next the beam terminal part is fitted into the semi-tubular arm part, after which holes are opened in the wooden structural members for clamping together with bolts.

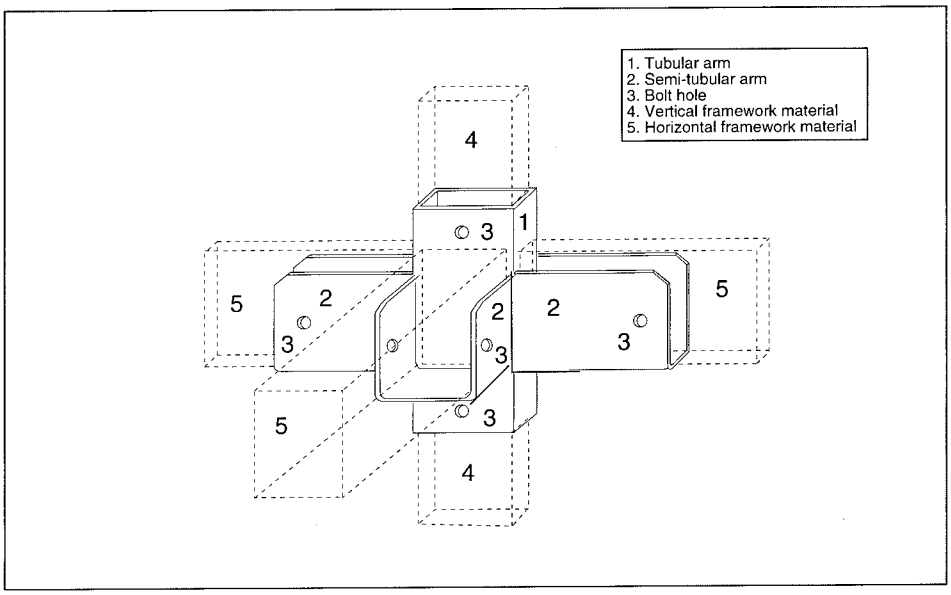
The King Joint joining method simultaneously introduces and integrates three new



King Joint

construction technology concepts in place of the conventional wooden frame method: the rigid joining and erection technique, the precutless technique and the sequential fixation and construction technique.

At the joint parts, the required structural member terminals are accommodated deeply and fixed firmly inside the respective arms which are assembled together with the metal fixtures beforehand, so the joints are obtained in virtually complete rigid structures. According to the King Joint joining technique, the beams are moved vertically with respect to the King Joint beam arms provided beforehand on the pillars fixed in position self-supported, accommodated and fixed in position inside the arms, and the fixation of all the



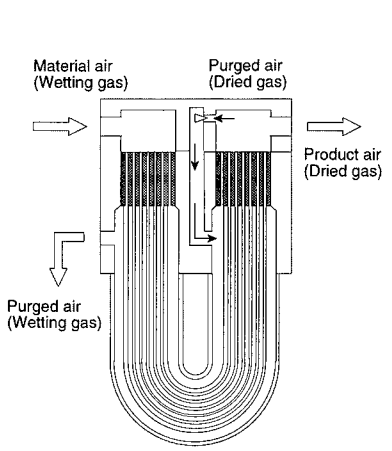
Configuration chart of K Joint

prescribed totally joined parts is completed. All main structural member fixation is accomplished sequentially to advance the respective framework assembling tasks, by which the entire construction is completed while constantly maintaining all the frameworks in a stabilized state.

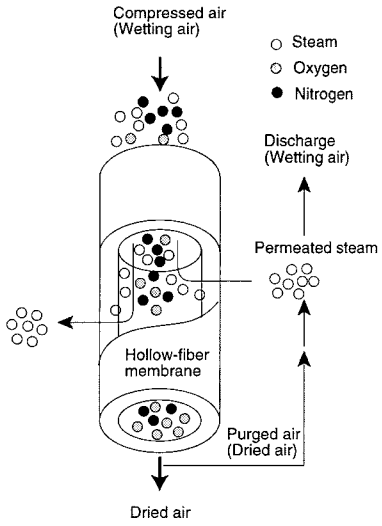
Most conventional types of metal fixtures insert the fixture welded plate-shaped extrusions into beam grooves to fixed them firmly into position. With the new metal fixture, the beams are fixed in position securely, so the beams are highly resistant to vertical oscillations. These fixtures are made of iron, but the company plans to market fixtures made of aluminum for use where corrosion is undesirable.

King Joint enables the positioning of pillars and beams as well as assembling tasks to be accomplished with ease at the worksites, and joining wooden and metal structural members is also possible. Patents are pending for the new fixture as a new type of metal fixture for construction purposes.

* ***Kanechu Co., Ltd.***
Public Relations Dept.
6-22, Kagurazaka, Shinjuku-ku, Tokyo 162
Tel: +81-3-3269-7156
Fax: +81-3-3269-1933



Construction of dehumidifying module



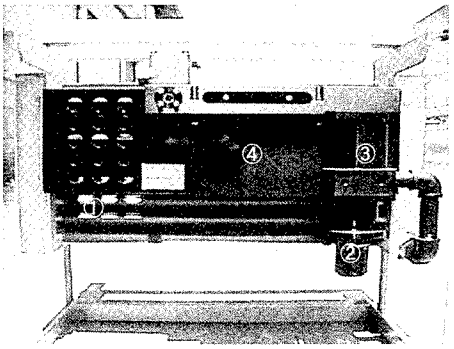
Dehumidification interaction of hollow-fiber membrane

97-11-006-02
Compact, Lightweight Dehumidifier for Railway Vehicles

Orion Machinery Co., Ltd., jointly with the Railway Technical Research Institute has developed a compact, lightweight dehumidifier for railway vehicle that has only one-fourth the size and one-fifth the weight of conventional counterparts.

The system consists of an aftercooler, a filtration unit and a dehumidifying module (hollow-fiber membrane). The aftercooler serves to cool the high-temperature compressed air discharged from the air compressor, and the filtration system protects the hollow-fiber membrane from the oil, dust and other substances discharged by the air compressor.

The system has a processing capacity of about 2000 l/min, and is fitted onto the compressors mounted on railway vehicles to remove the dust and oil particles contained in the compressed air. It displays a dehumidification effect by passing humid compressed air into the hollow-fiber membranes and dries air. The



①. Aftercooler ②. Automatic drain valve ③. Oil mist filter ④. Dehumidifying module ⑤. Check valve

membrane inside and outside vapor pressure difference causes the vapor inside the compressed air to be osmosed and to be discharged outside from the external walls together with the purged air. It prevents defective operations of braking systems and door opening-closing systems, and displays an anti-freeze effect in winter.

The internal dehumidification module consists of hollow fibers made of fluorine-based polymer membranes and withstands long use without requiring replacement. This eases maintenance work, and continuous system operation is possible without requiring a power unit. The humidifier has a length of 80 cm, depth of 35 cm, height of 52 cm and weighs about 60 kg. It is marketed at a domestic price of about ¥650,000.

* ***Railway Technical Research Institute***
Sales Dept.
1-24-1, Nishishinjuku, Shinjuku-ku, Tokyo 160
Tel: +81-3-5322-3562
Fax: +81-3-5322-3576

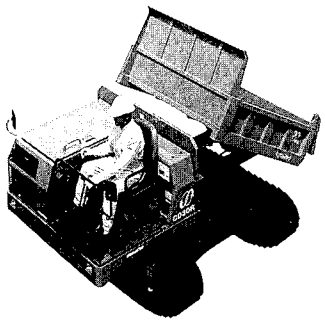
97-11-006-03
Crawler Carrier Enabling 360° Revolution of Cab and Vessel

Komatsu, Ltd. has developed and started marketing an entirely new type of rubber crawler carrier called Kuru-Kuru (revolving) Dump that enables the cab and the vessel to be revolved freely by 360°.

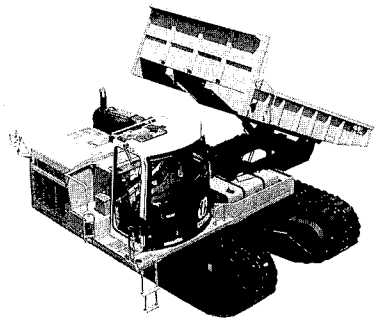
The crawler carrier is used at construction sites when advancing land preparation projects, in farmland preparation, forestry improvement and river development projects. It is in steady demand, but more recently, user preferences have shifted to types with durability and ease of use.

The new rubber crawler carrier displays a turning function which its conventional counterparts lack, as the upper part (cab and vessel) can be revolved freely by 360°. This function enables the soil to be moved easily to roadsides (side soil dumping), eliminates the need for direction changing for soil dumping and improves work efficiency substantially. There is also little need for U-turns or rapid turning by steer-

ing manipulation, so the worksite is not marred with crawler tracks. Also, since the direction can be changed with ease in narrow worksites, the crawler carrier can be used in narrow worksites.



CD30R



CD110R

Another advantage is that the operator engages almost entirely in forward running, so is spared from fatigue and can perform work safely. Further, since the frequency of changing directions together with the crawler is decreased considerably, the wear of ancillary running parts is prevented. Another advantage is that when the crawler carrier is stopped, the parking brake is engaged automatically. When the vehicle is run, the parking brake is disengaged automatically, so there is no fear of forgetting brake disengagement, or of running with the brake engaged, so the driver can concentrate efforts on work advancement.

The new crawler carrier is available in two models, Model CD30R (maximum loading capacity 3 t) and Model CD110R (maximum loading capacity 11 t).

* ***Komatsu, Ltd.***
Public Relations & Advertising Dept.
2-3-6, Akasaka, Minato-ku, Tokyo 107
Tel: +81-3-5561-2616
Fax: +81-3-3505-9662

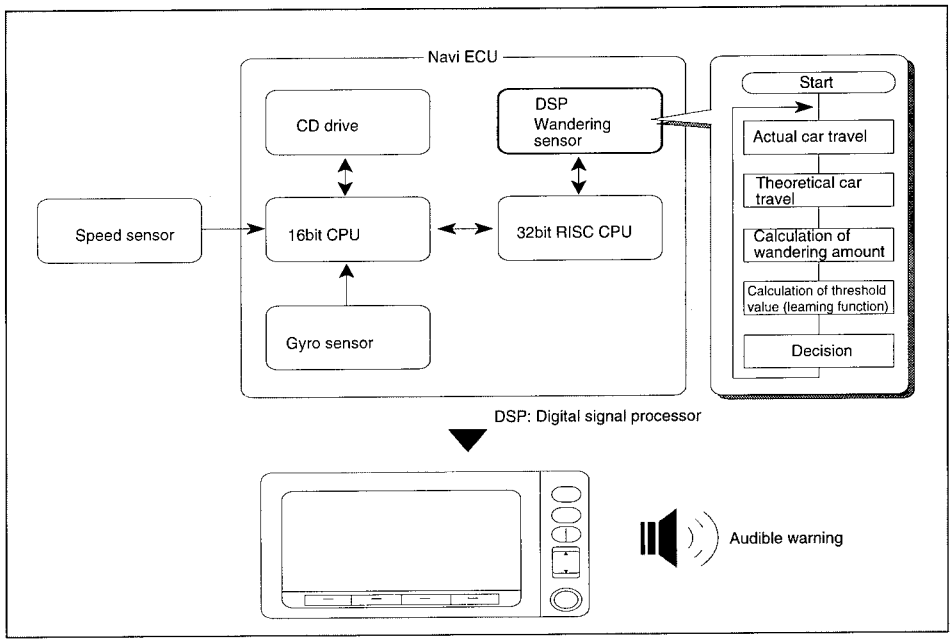
97-11-006-04

Honda Navigation System features Wandering Sensing Device and Inter Navi System

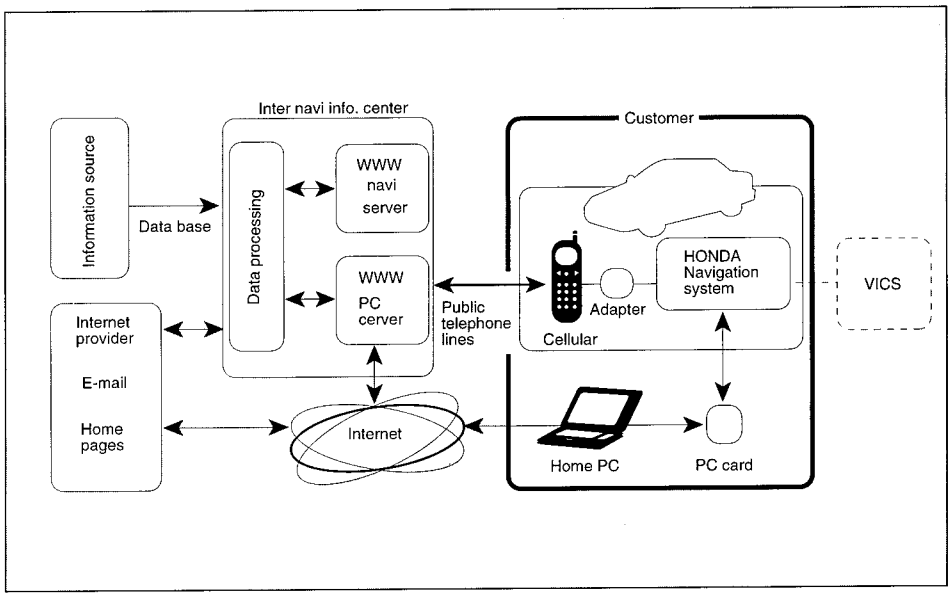
Honda Motor Co., Ltd. has developed the Honda Navigation System. This new system features a " wandering sensing device" with both visual and audible warnings, using information from the navigation system to detect any abnormal driving pattern as when falling asleep at the wheel. And it also features an internet type two-way communication system called Inter Navi System.

Honda's engineers attention was attracted to the fact that even without checking the driver's physical condition, the loss of concentration prior to sleepiness at the wheel could be detected by the wandering pattern found in the car's travel.

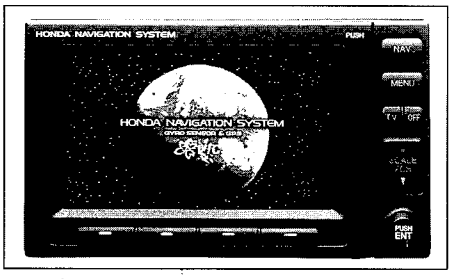
The "wandering sensing device" determines the car's travel route using the information provided by the speed and gyro sensors of the navigation system. From the actual travel route the system determines a theoretical, standard travel route which is then used to measure the amount of wandering and warn the driver. While thus



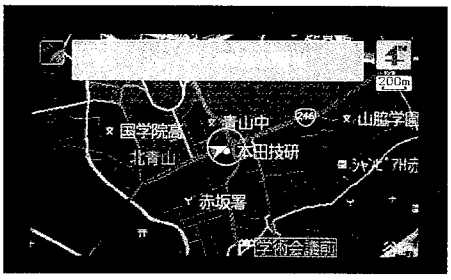
Wandering sensing device: description of the system



Inter navi system



Honda navigation system



Wandering sensing device

Inter navi system

monitoring the driver's driving pattern, the system's learning function revises the alarm setting conditions to accommodate for differing driving habits from person to person, thus allowing for an intelligent warning function.

In order to combine digital mapping with navigation systems, Honda have created for the first time in the world a www browser for navigation systems and an Inter Navi Extension Format to link the car location with the internet.

This provides information on a real-time basis. The user can access the Inter Navi information pages through the internet from the car as well as personal computer. The user can thus draw his driving plan on his PC before sensing the information to car. The driver can then unload the information in the car using a PC card. And it is also possible to access E-mail.

* ***Honda Motor Co., Ltd.***
Public Relations Div.
2-1-1, Minamiaoyama, Minato-ku, Tokyo 107
Tel: +81-3-3423-1111
Fax: +81-3-5412-1515

Energy & Resources

97-11-007-01

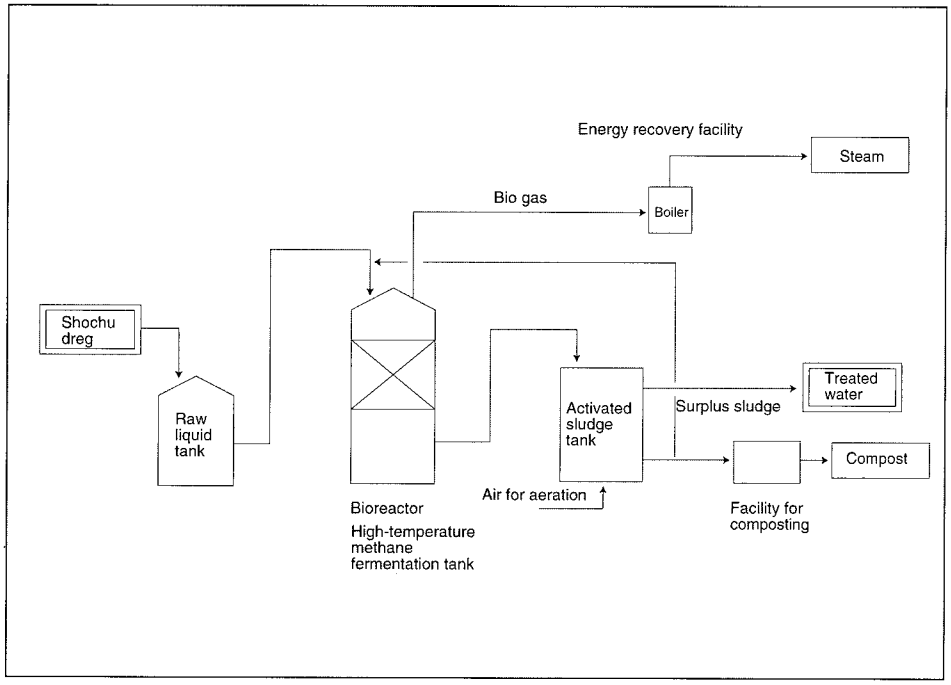
System for Methane Fermentation Treatment of Shochu Distillation Dregs

Kirishima Sake Distilling Co., Ltd. and Kajima Corp. have jointly developed a system for methane fermentation treatment of shochu distillation dregs, which involved in is based on Kajima Technology licensed by Proserpol—one of the biggest French companies concerning environmental projects. This system enables the shochu distillation dregs that were sprayed on farmlands as a special type of fertilizer to be recycled for reuse as a valuable resource.

The shochu distillation dregs undergo methane fermentation treatment using high-temperature methane microorganisms of excellent activity for use as a byproduct to recover energy in the form of methane gas, and the activated sludge generated in the secondary process is utilized as compost, so the new system is an environmentally harmonized type of system featuring both energy conservation and resources conservation.

Up till now, methane fermentation of shochu dregs had been regarded as quite difficult. Shochu dregs contain a large amount of high-density suspended solids, so the bioreactor is readily clogged to prevent stable system operation. Also, a separation system will be indispensable for removing the suspended solids, while additional costs are incurred for treating the separated solids, so there had been no merit in methane fermentation.

This system consists of a high-temperature methane fermentation bioreactor, an activated sludge tank for secondary treatment, a facility for composting surplus sludge, and an energy recovery facility. The bioreactor is a fixed bed type consisting of circular carriers made of fiberglass and developed using Kajima's advanced technologies. These carriers support dense adhesions of methane microorganisms of extremely high activity, so even if high-density solid substances are charged directly into the bioreactor, there is no clogging and the suspended solids can be decomposed smoothly.



Flow chart

The demonstration plant bioreactor (capacity 2.5 liters) is a fixed bed type that is shaped with circular carriers (diameter about 5 cm) made of fiberglass which Kajima developed jointly with Nippon Glass Co., Ltd. These carriers support extremely active high-temperature methane microorganisms for fermentation at 55 °C, so even if the shochu dregs are charged into the system at a rate of 0.5 m^3/day, over 70% is decomposed and converted continuously into methane gas and carbon dioxide gas.

Treating one ton of shochu dregs generates 40 m^3 of biogas, equivalent to a thermal value of 200,000 kcal. Kirishima Sake Distilling Co. generates 300 t/d of shochu dregs, so an aggregate thermal value of 60 million kcal can be recovered that is equivalent to about 50% of the plant's entire thermal energy consumption. The recovered biogas is usable conveniently as a fuel for the steam boilers.

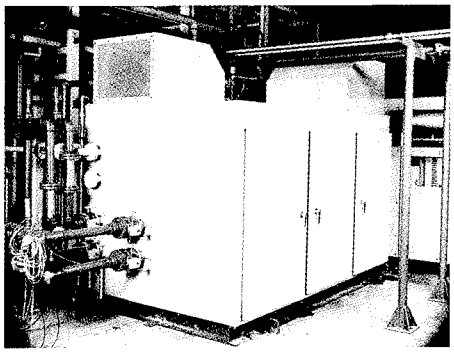
* ***Kirishima Sake Distilling Co., Ltd.***
4-28-1, Shimokawahigashi, Miyakonejo City, Miyazaki Pref. 885
Tel: +81-986-24-3211
Fax: +81-986-24-3288

97-11-007-02

Cogeneration System Using Gas Engine

Nissan Diesel Motor Co., Ltd., Tokyo Gas Co., Ltd. Osaka Gas Co., Ltd. and Toho Gas Co., Ltd. have jointly developed and started accepting orders for a high-efficiency, high-output electricity and thermoelectric supply system using a gas engine.

The cogeneration system is an excellent energy-conservation system that uses a diesel engine or gas engine to work the generator and generate electricity, and the engine cooling heat and exhaust gas heat are recovered for use in interior heating, hot water supply or interior cooling with an absorption chiller. Due to improvement of the combustion chamber shape (high compression ratio), optimization of gas suction and exhaustion timing as well as ignition timing, the thermal efficiency has been improved from the usual 32.6% to 34.6%, and the power output increased from 100 kW to 110 kW. The domestic selling price of a standard system is ¥35 million.



GP-110E

The newly developed Model GP-110E coordinated system features all these improvements, by which it features an excellent efficiency and high output. The heat radiation heat exchanger and other ancillary equipment are accommodated snugly inside the package, so installation and maintenance have been improved considerably. As a result, the introduction cost has been reduced by 10% and maintenance cost by 20%.

* ***Nissan Diesel Motor Co., Ltd.***
Public Relations Dept.
3-7-1, Kandanishiki-cho, Chiyoda-ku, Tokyo 101
Tel: +81-3-3294-9191
Fax: +81-3-3294-9298

97-11-007-03

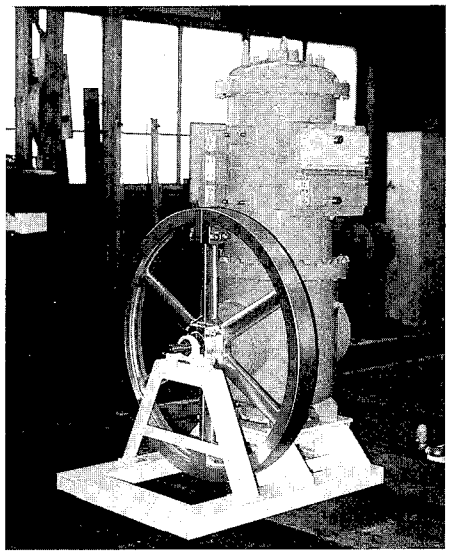
Engine Working Efficiently with Natural Energy Resources

Prof. S. Iwamoto and his research team of the Faculty of Engineering, Saitama University, have developed an engine that can be operated efficiently with natural energy resources such as geothermal and hot spring energy. Heat of about 100 °C is used to generate an output of about 1 kW, and the heat of the waste water of nuclear power plants and industrial plants can also be used. The engine does not emit any gas containing harmful substances, and is therefore usable as an engine for a clean form of power generation system.

The new engine belongs to the category of the Stirling Engine, and its pistons are worked by utilizing the changes in air expansion and contraction pressure by heating and cooling the air sealed inside the engine from the outside. It is designed with a large heat conductance area to prevent pressure loss inside the cylinders and to transmit the heat to the inside air with ease. The two cylinders are linked in a straight line with a heat exchanger in between to move the air over a minimum distance and to permit expansion and compression to be achieved smoothly.

As a result, the engine displays an output of about 1 kW, a commercial level, by utilizing a heat source of comparatively low temperature level. The engine can be utilized as a motive source as long as a minimum temperature difference of 80 °C is obtained by heating with hot water of 100 °C and cooling with water of 20 °C. A larger temperature difference will provide a larger output. In contrast to internal combustion engines represented by the gasoline engine, the fuel gas is not combusted inside the cylinder, so the engine does not generate any exhaust gas.

Against the backdrop of increasing social concerns to preserve a clean global environment, the new engine is anticipated as ideal for power generation by utilizing various types of energy resources such as the combustion heat of industrial wastes, biomass, exhaust gases of internal combustion engines, also solar, geothermal and hot spring heat. Utilizing chemical substances such as ethylene glycol as the heat conductance medium and heating these energy resources to about 100 °C with solar energy will permit this engine to be utilized as a motive source.



Engine that can be operated efficiently with natural energy resources

* ***Saitama University***
Faculty of Engineering
255, Shimoookubo, Urawa City, Saitama Pref. 338
Tel: +81-48-858-3450
Fax: +81-48-856-2577

Environment

97-11-008-01
Generating, Processing and Recycling of Ultrapure Water in a Closed System

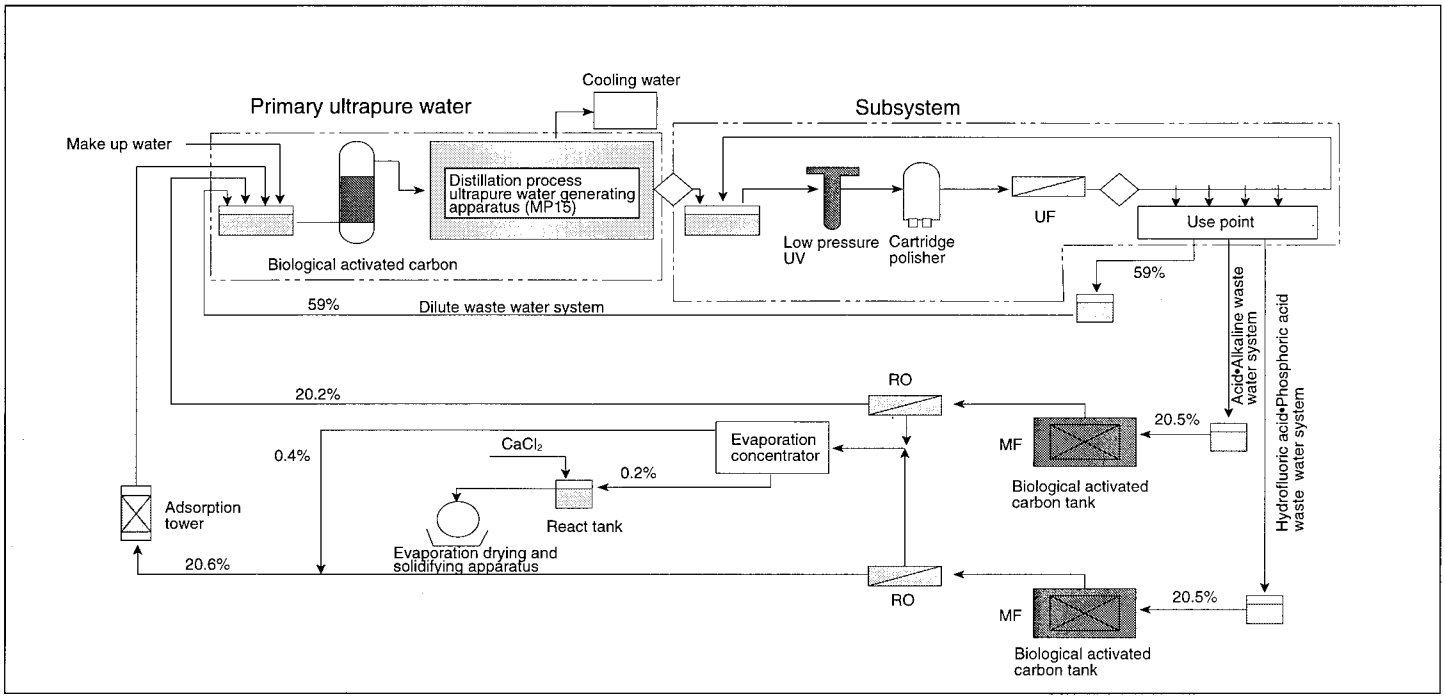
Hitachi Zosen Corp. has developed and is now marketing a total system that enables the generation of ultrapure water that is used to rinse semiconductors, liquid crystals and various other electronic components, and which enables nearly 100% of the used rinsing water to be subsequently treated, recovered and reutilized. This completely closed system applies Hitachi Zosen's self-developed ultrapure water processing technology, combined with either Hitachi Zosen's own or a commercially available water recovery system. Previously, only a simple ultrapure water generation system had been available, but this new total system also incorporates a waste water recovery and recycling system.

The system consists of a primary system which produces "pure" water based on a distillation process using fluidized bed-type biological activated carbon as pretreatment and a subsystem consisting of a ultraviolet organics decomposer, cartridge polisher and ultrafiltation membranes to produce the ultrapure water. The waste water recovery system consists of a combined hydrofluoric acid/ phosphoric acid waste water recovery system and an acidic/alkaline waste water recovery system. Before being fed back into the primary purification system, the used rinsing water is passed though biological activated carbon and micro filtration membranes for separation of microorganisms and waste.

This new total system completely removes silica and nonvolatile organic substances through distillation action. The high-temperature treatment incorporated in the system enables bacteria-free, high-performance deaeration to a dissolved oxygen ratio of less than 1 ppb. In addition, the system can provide ultrapure water from room temperature to 80 °C depending on the specific need for room, medium and high temperature rinsing.

The water is completely recycled, and the volume of chemicals used is one-sixth of the volume required by conventional water treatment systems. Additionally, sludge output of this innovative process is reduced by 80% as compared of conventional water treatment processes. System administration is simplified considerably and the water used for washing is recovered, recycled and reutilized most efficiently.

* ***Hitachi Zosen Corporation***
Public Relations Section
1-1-1, Hitotsubashi, Chiyoda-ku, Tokyo 100
Tel: +81-3217-8418
Fax: +81-3213-0905

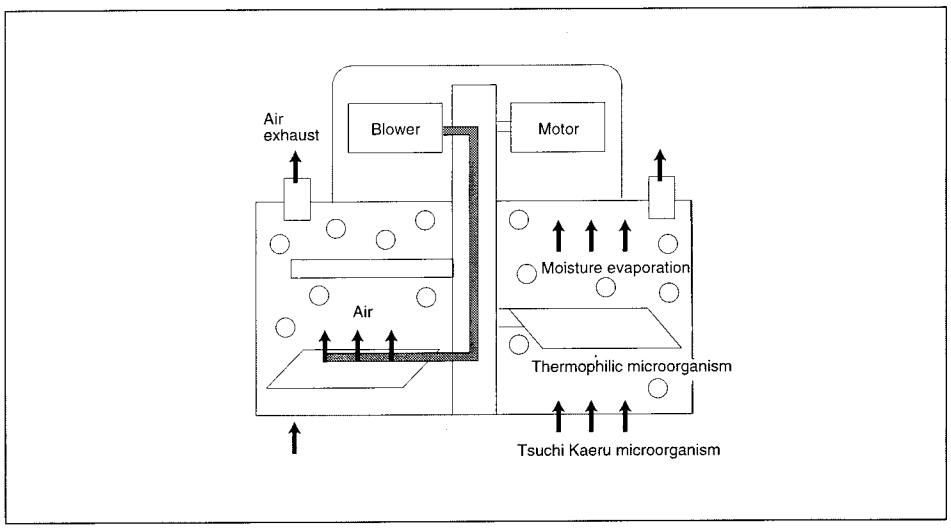


Ultrapure water / waste water total system

97-11-008-02
Raw Garbage Converted into Organic Compost with Microbes

Mag Suehiro Industrial Co., Ltd. and Assoc. Prof. K. Sakai of the Faculty of Engineering, Oita University, have jointly developed a system Tsuchi Kaeru (Back to the Ground) incorporating a deodorizer which converts raw garbage almost completely into safe organic compost free of pathological microorganisms by action of microorganisms.

The system consists of a stainless steel container, a deodorizer, an agitation mo-



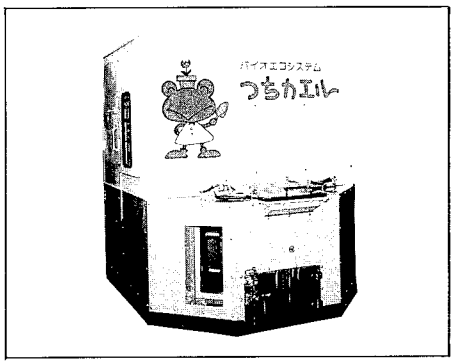
Flow chart of Tsuchi Kaeru

tor, a blower, a heater and a pump, and presently available in the Model T-80 version with a garbage processing capacity of 80 kg/day (domestic price ¥4,800,000) and in the Model T-160 version with a garbage processing capacity of 160 kg/day (price ¥6,900,000).

With these systems, the raw garbage is dumped into the container that is filled to about one-third with a culturing soil containing several types of thermophilic microorganisms selected and cultured as specific Tsuchi Kaeru microorganisms, the mixture is heated to 60 °C with a heater while stirring and mixing with blades provided at the container bottom, and air is passed through with a blower.

The microorganisms are activated and the raw garbage converted into water and organic components in 24 hrs. The water is vaporized as fermentation proceeds and exhausted outside. The raw garbage is reduced in volume from one-tenth to one-thirtieth its original bulk, so raw garbage can be dumped inside from day to day. When the volume of culturing soil increases, some is taken out and used as compost leaving the remainder inside. Safe and sanitary compost is obtained since pathological microorganisms are killed off by the high temperature and air passage.

The deodorizer is based on a system for a deodorizing fluid and a filter, and no offensive odor is effused outside. The system can be adjusted in four stages from coarse mixing to sludgy mixing by conditioning the water content of the culturing soil fed into the system prior to garbage



Tsuchi Kaeru

dumping, and all kinds of raw garbage can be treated such as leftover foods, fish, bread, vegetables and meats. The culturing soil (composted soil) can be extracted automatically by depressing a push-button, and an emergency stop push-button is provided at the upper part of the takeout port for use in emergencies. In addition, the system can be switched to Good Night when not using the system over long periods of time, to prevent putrefaction or molds. The system is designed for safe and easy operation, and has a low running cost due to its energy conservation design.

* ***Mag Suehiro Industrial Co., Ltd.***
Public Relations Section
1720, Suehiro, Usuki City, Ohita Pref. 875
Tel: +81-972-63-8848
Fax: +81-972-62-5351

Sales Dept.

* ***Social System General Laboratory Co., Ltd.***
3-4-2, Ohtemachi, Saeki City, Ohita Pref. 876
Tel: +81-972-23-4903
Fax: +81-972-20-0508

97-11-008-03

Water Purification Agent Made Entirely of Natural Resources

YLEX Corp. has developed a water purification agent to remove harmful substances such as heavy metals from target treatment water. It is made entirely of inorganic substances, is usable safely, and prevents the generation of harmful substances during the water treatment process. It is made as a dried powder and can remove suspended solids which are not settled in the water.

The ultraminiscule particles floating in water are charged with negative electricity, so are mutually repulsed by each other, and therefore never flocculate in water. Therefore, the water will never become clear and will remain polluted.

Normally, turbid water is treated by using an organic chemical consisting of macromolecular compounds, but this method is problematical in that harmful substances such as chlorine gas is generated in the treatment process. The new powdered water purification agent Elexite consists mainly of inorganic substances such as aluminum oxide and sodium oxide. The floating heavy metal particles dispersed in the water are coagulated and settled in 3-60 s when the powdered agent is mixed and stirred in the water. In addition, the agent coagulates proteins, so is effective for coagulating animal blood and wastes.

The agent is made of substances present naturally in the environment, so in contrast to agents made of artificial chemical substances is harmless to man and animals. Water purification effect is achieved simply by adding to the water appropriately, and since there is no need to adjust the pH value, the facility can be installed with ease and at a low capital cost. The agent is dissolved readily in waster, floc is generated rapidly after stirring, settled in 3-60 s subsequent to stirring, and can be dewatered with a slight pressure. The cake has an extremely low water content, the treatment facility has a long service life, and the supernatant water is clear so can be drained off without requiring aftertreatment.

Roughly one ton of foul water can be treated with 300-500 g of the agent, the precipitate can be recycled for use in a mix-

ture with agricultural soil, and expenses can be saved treating the water as an industrial waste. The agent is sold at a domestic price of ¥1,200/kg.

* ***YLEX Corporation***
Tokyo Headqurters
1-14-15- 201, Tamagawa, Denenchofu,
Setagaya-ku, Tokyo 158
Tel: +81-3-3721-7880
Fax: +81-3-3721-6991

97-11-008-04
Water-Sealing Function Monitoring System for Ultimate Waste Disposal Facilities

Fujita Corp. and Tatsuta Electric Wire and Cable Co., Ltd. have jointly developed and commercialized a Water-Sealing Function Monitoring System for ultimate waste disposal facilities, and started selling the system from July this year.

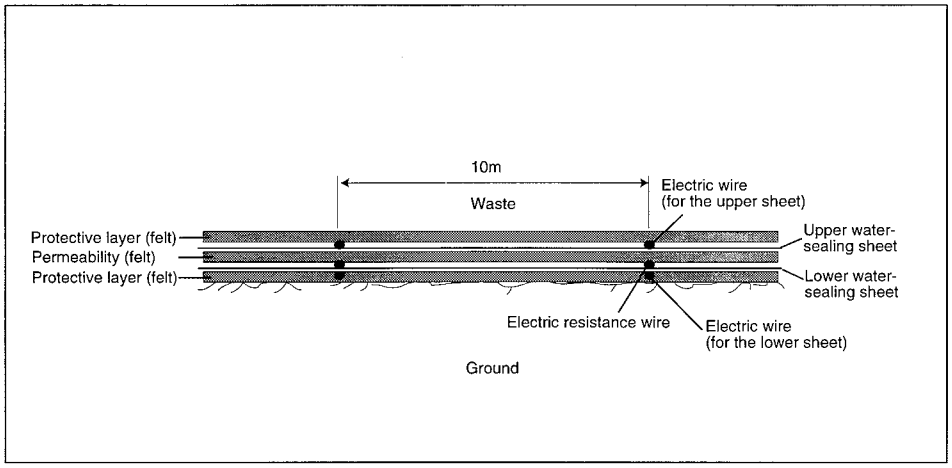
The new system applies the principle of the system that uses electric resistance wires to detect the leakages of water pipings, and is designed as a system that is suit for monitoring the water-sealing functions of flat type ultimate waste disposal facilities. Normally, these facilities use two layers of water-sealing sheets at their bottom and inclined parts. To supplement and protect these sheets, three layers of felt are installed in between the two layers of water-sealing sheets as well as above and below the sheets, or the system consists of a total of five layers.

The upper and lower layers of felt incorporate electric wires to pass a constant electric current, and the middle sheet incorporates electric resistance wires which serve as sensors. While the water-sealing sheets are functioning properly, no current is passed through the resistance wires, but whenever some irregularity occurs with the water-sealing sheet, a current starts flowing in the resistance wires installed in the middle of the faulty part. Due to the voltage fluctuations generated, it is possible to discriminate at what position the irregularity occurred, and whether in the upper or lower sheet.

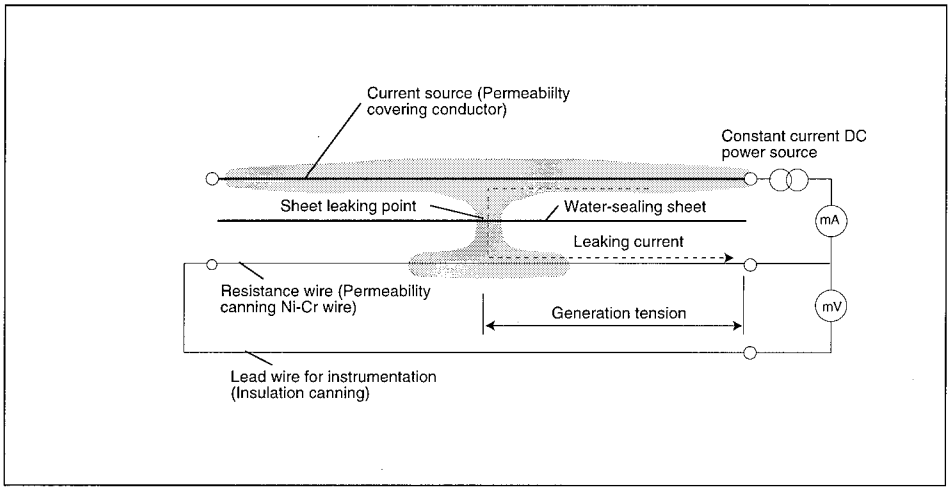
The position of the irregularity in the monitoring system longitudinal direction is deduced from the distance of the voltage fluctuation from the measuring circuit, and the irregularity in the breadthwise direction from the voltage fluctuations of the adjacent resistance wires. Also, with this system, related data are transmitted to the administration office situated at any suitable remote place for display on a personal computer and for accurate measurement and control.

The system consists of the electric wires for the upper sheet, the resistance wires, the electric wires for the lower sheet, a constant-current power unit, a current measuring circuit and a current measuring computer. The system will be sold at a domestic price of ¥1,200-1,400/m^2 (only the monitoring system).

* ***Fujita Corporation***
4-6-15, Sendagaya, Shibuya-ku, Tokyo 151
Public Relations Dept.
Tel: +81-3-3402-1911
Fax: +81-3-3796-2346



Water-sealing function monitoring system cross section



Measuring principle of water-sealing function monitoring system

97-11-008-05
Machine for Crushing Park and Forest Pruning Timber

Matsumoto Industry Co., Ltd. has developed a trimmed timber crushing machine Super Shredder KF-150A for treating the timber trimmings generated by park and forest pruning.

Up till now, the waste timber (trimmed branches) generated at park, streetside and forest pruning sites was bundled with ropes, loaded onto trucks, and stacked in piles at the treatment center, or combusted as waste material. However, this method involves environmental disruption and other issues, as well as massive treatment costs, so the development of an efficient wood chipper had been needed.

Super Shredder introduces a unique drum cutter and shredding mechanism in place of the disk cutter free-hammering system that is adopted by conventional types of wood chippers, with the advan-

Super Shredder KF-150A

tages of less noise, finer chip size, compact and lightweight chipper body and high performance, which contribute immensely to work efficiency improvement, cost reduction and effective recycling.

The machine has an overall dimensional range of less than 1 m, has a total weight of only 300 kg, and can therefore be mounted with ease on a truck or crawler carrier, so it is possible to work at pruning sites. While featuring a compact design, the machine displays a capacity comparable to that of a large machine. Treatment of trimmed branches with diameters of up to 15 cm, capacity of 2 m^3/hr of branched leaves, 3 m^3/hr of trunk and treatment of tree in general including bamboo, bamboo grass and weeping willow are possible. Noise generation is low, so it is usable in urban areas.

Super Shredder adopts the two-stage treatment method for a drum cutter and a unique shredding cutter, by which the treated timber is converted into fine, uniform chips which can be recycled as compost material, tree mulching material, while the improved shredding knife enables even soft materials such as leaves to be treated efficiently.

An automatic feed roller worked with a hydraulic motor is provided for feeding the trimmed timber, so operations are performed smoothly and speedily, also safely. A hose with an overall length of 7 m is usable for discharging the treated timber for convenient loading of treated chips onto trucks, or for directly spraying the treated chips onto vegetation and surrounding areas at the pruning site.

* ***Matsumoto Industry Co., Ltd.***
Public Relations Dept.
1-50, Shimada-cho, Fuji City, Shizuoka Pref. 417
Tel: +81-545-52-2520
Fax: +81-545-53-3456

Biotechnology & Medical Science

97-11-009-01

Sensor for Measuring pH Values at Multiple Measuring Points

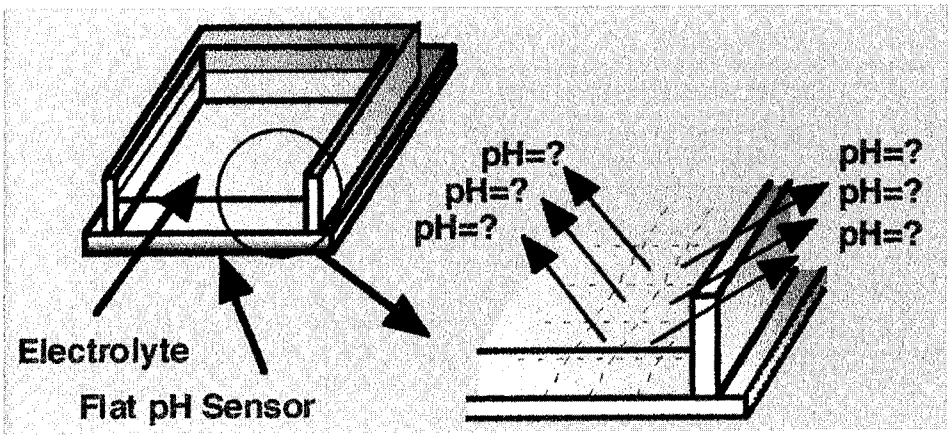
Horiba Ltd. has developed of a novel pH measuring technology for determining values at multiple measuring points in a small area. The measurements are made into an image to indicate the distribution of pH values. In collaboration with the Research Institute of Innovative Technology for the Earth (RITE), the company has been aiming to prepare a method for the investigation of, among other areas, the behavior of microorganisms.

The conventional pH meter uses a glass electrode which requires a substantial quantity of homogeneous test solution. Different pH values of a test solution at more than one point could be simultaneously measured if many electrodes are dipped into the solution, but the operation is impracticable. The conventional meter cannot be used when there is too little test solution.

This technology uses a sensor chip with $Si_3N_4/SiO_2/Si$ structure and test solution (electrolyte) is spread over the top layer of the chip. When in use, a bias voltage is applied between the solution and the chip, and a laser beam strikes the Si layer from under the chip. The incident light is modulated with a certain frequency (e.g. 5 kHz), and generates an AC photocurrent in the chip with a magnitude depending on the pH value of the solution just over the spot of the laser bombardment. The current is easily determined with a potentiometer, and interpolated into the pH value.

Because the probe beam is thin with a tiny footprint, pH values at different points in the solution can be measured independently if the beam is swiftly scanned over from one point to another. The measurement is performed with a resolution of down to 0.1 pH at spatial intervals of as little as 100 μm. For example, if a 6.4 × 6.4mm working field is used with 64 × 64 measuring points, measurement is carried out only within 30 sec, a satisfactory time for a very wide range of practical uses. The values acquired are processed by a PC to create an image indicative of the distribution of pH values in the sample. This visualizes what is happening in the solution in the term of pH. When each pH is scaled with colors as with pH indicators, the image is quite picturesque.

One of the most promising applications is monitoring the behavior of living microorganisms, which allow a new approach toward bioremediation (pollution treatment by microorganisms). The company has tentatively set up a microscope with the sensor incorporated and called



Concept of sensor measuring pH values at multiple measuring points

Scanning Chemical Microscope. They have started marketing research of this new technology both domestic and international. They also envisage reducing the spatial resolution to 5 μm.

* ***Horiba Ltd.***
Public Relations
2, Miyanohigashimachi, Kishoin, Minami-ku, Kyoto City, Kyoto 601
Tel: +81-75-313-8121
Fax: +81-75-321-5648

97-11-009-02

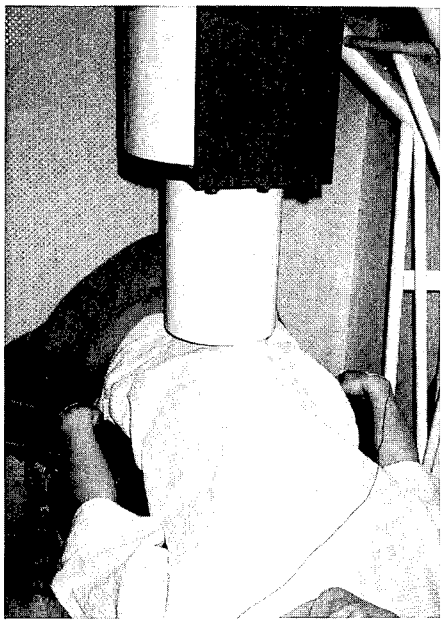
Team Develops Non-invasive Procedure for Examining Fetal Heart

A team of scientists from the Institute of Clinical Medicine, University of Tsukuba and Hitachi, Ltd. has developed a procedure for non-invasively examining the heart of a fetus. By using superconducting quantum interference devices (SQUIDs) to measure the minute magnetic fields generated by the heart, the team, headed by Professor T. Mitsui, was able to distinguish between the magnetic signals generated by the fetal heart and the mother's heart. The new procedure will make it possible to diagnose fetal heart conditions by means of an examination that takes just a few minutes to complete.

The SQUIDs were developed by the Superconducting Sensor Laboratory, one of the founders in the Japan Key Technology Center.

At present, the most common way of diagnosing fetal heart ailments is through an ultrasound examination. While ultrasound can reveal the shape of the heart and provide some information about the working of the heart and blood flow, it is unable to provide the type of electrophysiological information directly related to cardiac activity that is furnished by an electrocardiogram or magnetocardiogram. Attempts have been made to obtain electrocardiograms from the fetal heart using electrodes placed on the mother's abdomen. However, the electrical fields emitted by the fetal heart are so minute that it is difficult to separate them from the electrical signals generated by the mother's heart.

Using a SQUID-based sensor enables the weak magnetic fields generated by the fetal heart to be measured by placing the sensor on the mother's abdomen. Measurements obtained with this method are virtually unaffected by the amniotic fluid or fetal fat, making it possible to obtain signals with a higher resolution than an electrocardiogram.



Fetal electrocardiogram

A new sensor was developed that reduces the influence of the mother's myocardial magnetic field on the measurements and makes it possible to accurately measure the cardiac magenetic field of the fetus. The fetus's heart is normally about 6cm from the surface of the mother's abdomen, so the new sensor was developed with a high sensitivity that, compared to a conventional sensor, gives it more sensitivity at a deeper depth. The new procedure can also be used to perform separate measurements on twins.

Fetal electrocardiograms can be obtained as early as the twentieth week of pregnancy. Thus, the new procedure should make possible the early detection of fetal cardiac ailments, and thereby facilitate treatment of the condition, either before or immediately after birth.

* ***Hitachi, Ltd.***
Public Relations Secretary's Office
4-6, Surugadai, Kanda, Chiyoda-ku, Tokyo 101
Tel: +81-3-3258-1111
Fax: +81-3-3258-5480

97-11-009-03

Hybrid Artificial Retina

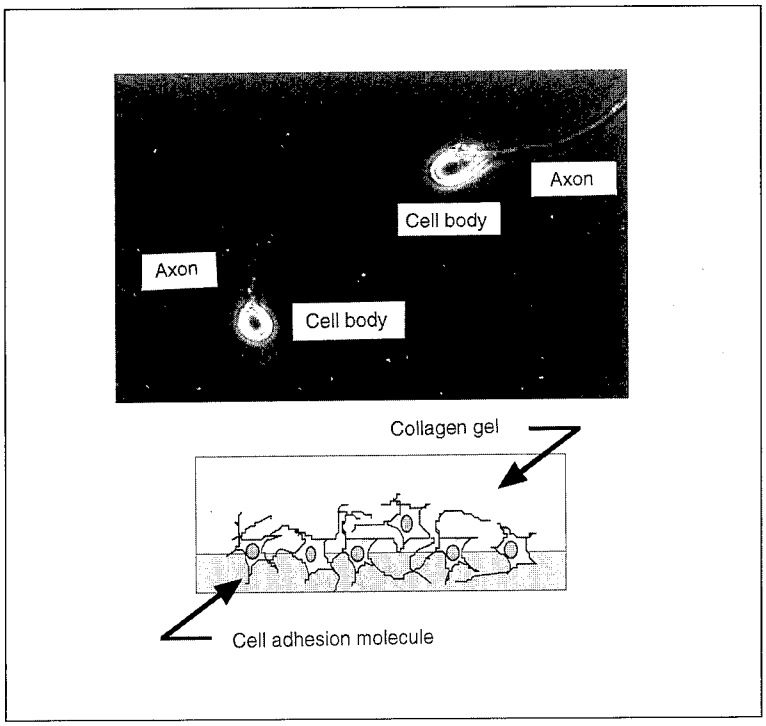
A joint research team of the Institute of Physical and Chemical Research (RIKEN) under Dr. T. Yagi of the Bio-Mimetic Control Research Center and Nagoya University under Prof. Y. Uchikawa of the Graduate School of Engineering have developed a prototype of an artificial retina consisting of (living) nerve cells and semiconductors. Experiments using the device overlapped in the same way as newt retina cells confirmed that light beams are sensed and electric signals transmitted to the retina cells.

Up till now, no treatment has been available to recover the sense of vision subsequent to loss of sight, but the development of the artificial retina provides a bright outlook for vision recovery. The research team plans to further improve the bio-compatibility of the new retina to commercialize an artificial retina for implantation in the human eye.

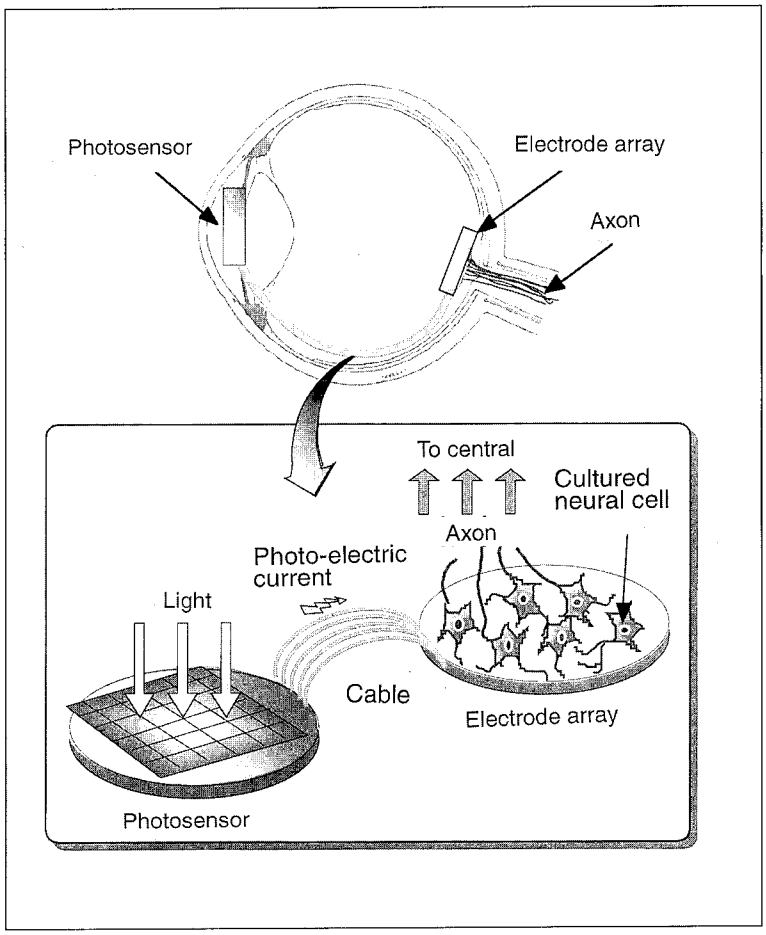
The artificial retina has a construction in which two devices like small coins are linked together with a cable. The photosensor (photosensitive sensor) that converts light beams into electric signals is embedded in the crystal part of the eyeball. Another part that connects to this retina system has a construction consisting of a thin electrode array implanted with nervecells. In the basic experiments conducted previously, the nerve cells of the newt were used.

The electric signals transmitted from the photosensitive sensor via the cable are induced into electrodes with numerous micrometer scale notches and stimulate the nerve cells implanted between the electrodes. Another distinct feature of this system is that the nerve cells implanted between the electrodes are grown toward the brain to transmit electric signals to the brain. The system is applicable to cases in which there is neither an organ to capture light signals for conversion into electric signals, nor a nerve to transmit the electric signals to the brain.

The human retina has about 800,000 photosensitive elements which enable parallel processing of signals, but in the experiments, only 64 photosensitive elements were used to confirm the theoretical performance of the artificial retina. The artifi-



Cultured neural cell



Hybrid artificial retina

cial retina has a construction in which newt retina cells are mounted directly on a silicon photosensitive element available on the market.

The accompanying photo shows the nerve cells of the newt two weeks after commencement of culture. The cells assume a spherical form initially, but the axons start elongating after a while as shown by the photo. Normally, a culture solution is necessary for cell culturing. However, with the artificial retina, the cultured neural cells are implanted inside the eyeball, so a solution will be spilt. Therefore, a cell bonding substance is used to bond the cell on the substrate, followed by the coating of collagen containing the culture liquid. Thus, the culturing liquid is not spilt even if the substrate was inverted, and the cells can be retained securely by bonding on the base of the substrate.

The signal transmittance efficiency between the elements and cells is a vital factor for the development of artificial retinas, but the electric signals from the photosensitive elements can stimulate the retina cells efficiently.

* ***Institute of Physical and Chemical Research (RIKEN)***
Bio-Mimetic Control Research Center
2271-130, Anagahora, Shimoshidami,
Moriyama-ku, Nagoya, Aichi Pref. 463
Tel: +81-52-736-5867
Fax: +81-52-746-5868

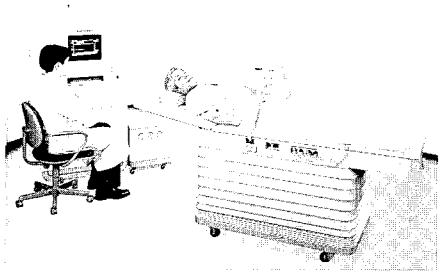
97-11-009-04
Apparatus for Treating Prostatomegaly

Yamanoto Vinita Co., Ltd. has started marketing a newly developed therapy unit device Proseight for treating prostatomegaly with radio frequency waves.

This unit is based on the cancer thermotherapy technique and was developed to heat the internal parts of the prostate gland uniformly and widely for treatment. Compared with the conventional type of apparatus that uses microwaves emitted from a catheter type electrode inserted into the urinal canal, Proseight uses radio frequency (RF) waves of 8 MHz which provide deeper tissue penetration, and by using a catheter type electrode inserted into the urinal canal and external electrodes, the RF waves are concentrated at the af-

flicted part. Also, the catheter type electrode inserted into the urinary canal is much smaller than conventional types of electrodes, so the discomfort of patients is alleviated substantially.

Concentrating the radio waves of 8 MHz at the afflicted area for about one hour generates local heating at about 45 °C, dilates the urinal canal and treats prostatomegaly, so hospitalization becomes unnecessary. There are also no side effects, so the discomfort to elderly patients is greatly reduced.



Proseight

The treatment of prostatomegaly, in which the enlarged prostate gland closes the urinal canal, is presently being conducted largely by drug treatment or by performing a prostate operation. The new apparatus is marketed at a domestic price of ¥62 million.

* ***Yamanoto Vinita Co., Ltd.***
Medical Dept.
6-3-12, Ueshio, Tennoji-ku, Osaka City, Osaka 543
Tel: +81-6-771-0605
Fax: +81-6-771-6898

97-11-009-05
Novel Marine and Soil Enzymes Usable as Biosensors

Assoc. Prof. K. Sode and W. Tsugawa of the Department of Biotechnology, Faculty of Technology, Tokyo University of Agriculture and Technology, have discovered two new types of enzymes usable as biosensors, one from the sea and the other from the soil. The enzymes are used for making measurements such as the sugar value in blood and urine. The enzyme discovered from the sea is a member of the family of pyrroloquinoline qunone-dependent glucose dehydrogenases (PQQGDH) and is salt-resistant. The other enzyme discovered from the soil is a co-factor binding enzyme and is heat-resistant. Glucose oxidase has been utilized extensively as the enzymic sensor component for glucose measurements. PQQGDH is currently attracting increasing attention as a suitable enzyme for biosensor construction since it is insensitive to oxygen and is also a co-factor binding type enzyme displaying intense catalytic activity.

The research team screened PQQDH obtained from marine bacteria. Seawater samples were collected from 24 coastal locations in Japan, and these samples were plated directly onto eosin-methylene blue medium agar. Dark blue colonies, which indicated a pH decrease resulting from the assimilation of glucose, were selected and subjected to PQQGDH assays which were carried out using the membrane fraction of each marine bacterium as the source of the enzyme. As a result, a type of enzyme was discovered that can withstand salinity of up to 10%, in contrast with ordinary types which lose activity at a salinity of about 1%.

A novel type of thermostable glucose dehydrogenase was purified from a gram-negative moderate thermophilic bacterium isolated from the soil near a hot spring. The homogeneously purified enzyme sample showed two peaks at the optimum reaction temperatures, i.e., at about 45 and 70 °C. Conventional types of enzymic sensors become unusable after several months, but using these new types of enzymes prolongs the service lives of these enzymes to as long as one year to several years.

* ***Tokyo University of Agriculture and Technology***
Department of Biotechnology, Faculty of Technology
2-24-16, Nakamachi, Koganei City, Tokyo 184
Tel: +81-423-88-7027
Fax: +81-423-88-7027
E-mail: sode@cc.tuat.ac.jp.

97-11-009-06
Rose Extracts Display Anti-Allergy Effects

Dr. Ra Chisei and a joint research team of researchers belonging to the Department of Immunology, School of Medicine, Juntendo University and Nikka Whisky Distilling Co., Ltd. have discovered that rose extracts have suppression effects on allergic reactions. The extracts were added to human cultured leukocytes and were confirmed to suppress the activities of allergy-causing cells.

IgE that induces the immediate allergic reaction is known to bind to the alpha-chain extra-cellular domain of the IgE receptor (FceRI) on mast cells and basophils. Therefore, research is trying to discover some substance that would inhibit binding of human IgE to IgE receptors. Research is investigating plants to identify substances which display an inhibitory effect on IgE-IgE receptor binding.

In experiments, several dozen types of white, yellow and other rose petals were used. To investigate the anti-allergic effects of these rose extracts, genes which produce human IgE receptor were introduced into Chinese hamster cells to express functions similar to those of human cells. The genes which were introduced created receptor proteins which bind IgE, an antibody, and serve as the switch to cause the allergy.

Powdered rose petals were passed through hot water, and when the cells were incubated with the rose extracts, the effect of inhibiting the IgE-binding was observed. When the extract were added to the culture of basophils, a type of human leucocyte, the discharge of histamine, a cause of allergic rhinitis, was dramatically reduced. At present, the anti-allergic substance has not yet been completely identified, but there is a high probability that the material is a new, entirely unknown chemical substance.

The antiacidic effects of this extract with respect to linoleic acid were studied. The extract displays a more distinct antiacidic effect than BHA, and the substance displays a highly effective antibacterial effect against bacteria related to atopic dermatitis at a density of up to 0.1%. At present, the research team is advancing research establishing techniques for the isolation and fixation of substances which inhibit the binding of human IgE receptors.

* ***Juntendo University***
Department of Immunology, School of Medicine
2-8-4, Hongo, Bunkyo-ku, Tokyo 113
Tel: +81-3-3818-7105
Fax: +81-3-3813-0421

FLASH

Robot Displaying Emotional Expression

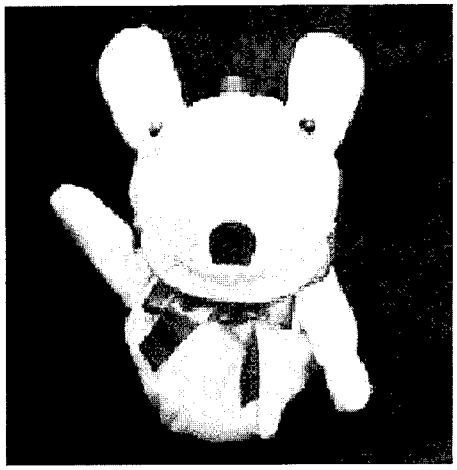
PROF. K.Yamafuji and his research team of the University of Electro-Communications have developed a pet robot capable of expressing simple emotions. The robot arms, ears and mouth are used to display emotions such as delight, anger and surprise. These emotions can be read out from the robot motions with ease by persons of various age groups.

The capability of mutually sensing emotions and engaging in communications could be established between robot and man when a robot compatible with the environment senses, understands and responds to what human beings desire to do or say, and when man can recognize the responses. By incorporating robots with emotions, an exchange of intentions will become possible between robot and man, which will have the effect of making life in a robot environment more pleasant.

Research is presently in progress to develop a robot capable of responding to human desires and environmental conditions, or a robot that is compatible with the combination of man and environment, a robot that operates in an ordinary human living environment without exerting any sense of coercion or incompatibility in human beings, and a robot capable of expressing emotions and desires which can be observed and understood by man.

The robot is a dog type that can easily be carried. It appears like a stuffed toy, and can move its legs, ears, neck, mouth and tail. The drive units of the legs, neck, ears have two degrees of freedom, and the mouth and tail one degree of freedom, so the robot has a total of ten degrees of freedom. The cableless mode is adopted for maintaining smooth relations with man, and two touch sensors are equipped to enable communications with man by the vital means of touch to transmit desires to the robot. Also, to enable the display of many other emotions, the robot is equipped with siren-sounding lamps at its eye and head parts.

When happy, the robot shakes its legs, and when angry, its eye lamps are lighted and its body trembles. It is programmed to display a series of eight emotions such as surprise, sadness, agreement, refusal, call-out and display of an emergency. Experiments were conducted to see to what extent persons aged about 10 to over 70 could discriminate the robot emotions, showing that the accuracy for sensing the sense of happiness was 89%, anger 79% and call-out 67%, so two-thirds of the robot emotions were understood accurately by all age groups.



Pet robot

* ***The University of Electro-Communications***
Dept. of Mechanical and Control Engineering
1-5-1, Chofugaoka, Chofu City, Tokyo 182
Tel: +81-424-83-2161
Fax: +81-424-84-3327
E-mail: yamafuji@mce.uec.ac.jp

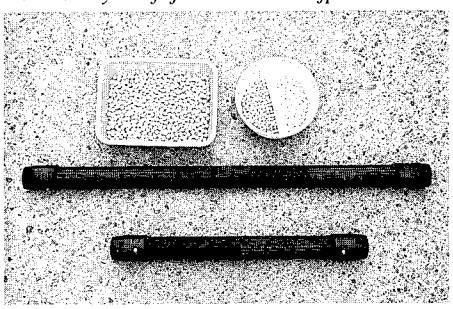
Ceramic Pipe for Water Activation

NAGANO Ceramics Co., Ltd. has started marketing a Ceramic Activation Pipe that activates water simply by packing the pipe with a special type of ceramic ball depending on the specific need and installing the pipe inside a water storage tank or water purification tank.

A meshed pipe made of plastics with a length of 1,000 mm and diameter of 75 mm is packed with ceramic balls with about 1% of the tank capacity for drinking water, or balls with about 0.1% of the tank capacity for water sterilization and waste water/sludge treatment tanks.

The characteristics of the ST Series ceramic pipes for drinking water are the suppression of rusting inside the tanks and pipes, the conversion of the original water into weak alkaline water containing only minuscule clusters, and the provision of water free of chlorine odor. The C Series ceramic pipes for water sterilization have the effect of suppressing the generation of legionella and E. coli microorganisms inside the tank, preventing the generation of pathological E. coli (O-157) and are suitable for use in water cooling and water cleaning towers.

The P Series ceramic pipes for waste water and sludge treatment activate the microorganisms inside the tank to promote decomposition of foreign substances and suppress offensive odors. Sludge decomposition costs are reduced since surplus sludge is not generated. The BOD and SS values of water are also lowered and the transparency is also improved. In addition, the generation of water-bloom and algae is suppressed and ponds are made cleared.



Ceramic Activation Pipe

The pipe with ceramic balls is marketed at a domestic price from ¥100,000 to ¥400,000, depending on its specifications.

* ***Nagano Ceramics Co., Ltd.***
Public Relations Dept.
25-1, Uchikawa, Toguramachi,
Hanishina Gun Nagano Pref. 389-08
Tel: +81-26-275-3559
Fax: +81-26-276-6520

JETRO

Japan External Trade Organization

Machinery and Technology Department